

Air Quality Monitoring in the County of Grande Prairie

December 1 to 15, 1998

Alberta Environmental Protection (AEP) is currently conducting an intensive air quality monitoring survey in the County of Grande Prairie. The objectives of the air monitoring survey are to: (1) determine maximum air pollutant levels in the region; (2) map the distribution of air quality within the County; and (3) compare air pollutant levels in the County with air quality guidelines and with air pollutant levels at other locations in Alberta. The monitoring survey was initiated on December 1, 1998 and is expected to be complete by the end of the calendar year 1999. This monitoring survey is part of an unannounced, routine air quality monitoring program that is conducted throughout the province by AEP.

The AEP Mobile Air Monitoring Laboratory (MAML) was used to monitor air quality on 12 days in the first half of December at 23 locations in the County of Grande Prairie. Monitoring was conducted in a broad rural area west, northwest and northeast of the City of Grande Prairie between Townships 70 and 76 to the Alberta/British Columbia border. The focus of this monitoring was to collect air quality data downwind of industrial facilities and at communities in the area. Air quality parameters monitored by the MAML during this survey included sulphur dioxide, hydrogen sulphide, total reduced sulphur, hydrocarbons, particulates, oxides of nitrogen, ozone, carbon monoxide and ammonia. Additional air quality monitoring was conducted using other monitoring techniques at locations where elevated air pollutant levels were measured.

The following report is a summary of air quality monitoring conducted in December 1998. AEP will conduct additional monitoring using the MAML and other monitoring techniques in the spring, summer and fall of 1999.

Major Findings

- (1) Concentrations of air pollutants measured in the County of Grande Prairie survey were below Alberta's Ambient Air Quality Guidelines. Maximum one-hour concentrations were:

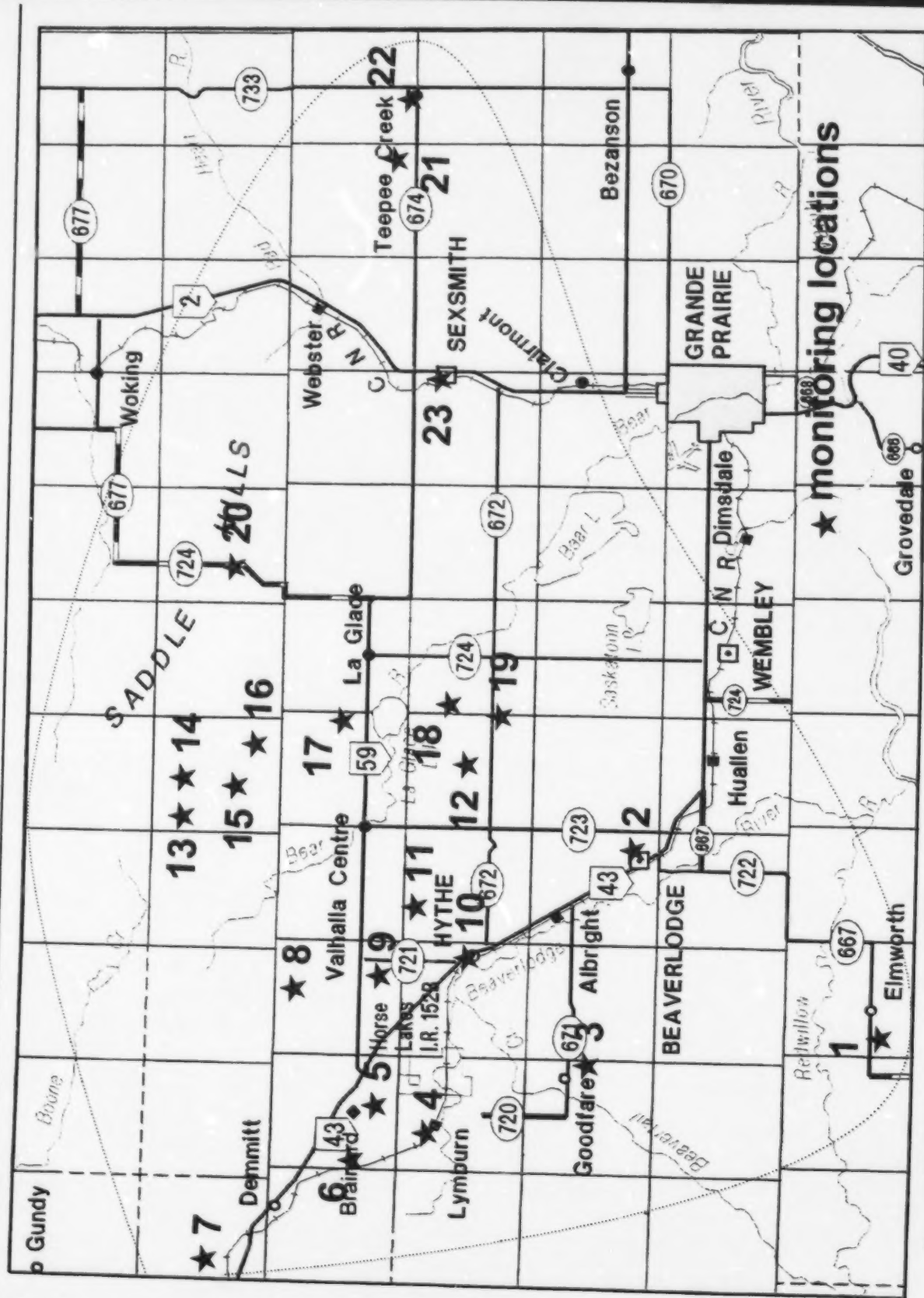
- 5% of the one-hour guideline for sulphur dioxide;
- 90% of the one-hour guideline for hydrogen sulphide;
- 52% of the one-hour guideline for ozone;
- 9% of the one-hour guideline for nitrogen dioxide;
- 5% of the one-hour guideline for carbon monoxide; and
- less than 1% of the one-hour guideline for ammonia.

- (2) Sulphur dioxide concentrations were low at all monitoring locations. The highest concentrations were recorded at Site #20 (located 10 km northeast of La Glace) and Site #6 (located 19 km northwest of Hythe). Maximum one-hour concentrations at these locations were 0.008 and 0.006 ppm (parts per million), respectively. Peak five-minute concentrations at these two locations were 0.020 and 0.019 ppm, respectively. The one-hour guideline for sulphur dioxide is 0.170 ppm.

- (3) Elevated hydrogen sulphide and hydrocarbon concentrations were recorded at Site #18 (located 8 km southwest of La Glace) from 6:30

to 8:40 p.m. on December 1. The maximum one-hour hydrogen sulphide concentration during this time period was 0.009 ppm. This value is below the one-hour guideline for hydrogen sulphide of 0.010 ppm. The maximum total hydrocarbon concentration during this time period was 6.8 ppm. This concentration is about 3.5 times higher than natural background hydrocarbon levels (2.0 ppm). These elevated concentrations were likely caused by fugitive emissions, or leakages, from industrial sources in the area. An air sample collected at this location showed that concentrations of benzene, toluene, ethylbenzene and xylenes were well below air quality guidelines for Alberta and Ontario. The benzene concentration in this sample was 3.0 $\mu\text{g}/\text{m}^3$ (micrograms per cubic meter). The interim one-hour guideline for benzene in Alberta is 30 $\mu\text{g}/\text{m}^3$.

- (4) Elevated hydrocarbon concentrations were also measured at Site #13 (located 14 km north of Valhalla Centre in the Saddle Hills) from 5:30 to 6:50 p.m. on December 2. The maximum one-hour concentration at this time was 7.2 ppm. The source of hydrocarbons at this location was likely fugitive emissions from a local industrial facility.



Ambient Air Quality Survey Monitoring Area

Monitoring Locations	
Site #	Nearest Facility or Community
Site 1	Canadian Hunter Elmworth gas plant
Site 2	Beaverlodge Research Station
Site 3	Crestar Goodfare gas plant
Site 4	Locality of Lymburn
Site 5	Brainard Area
Site 6	AEC Hythe gas plant
Site 7	Alberta/BC Border
Site 8	Martin Lake area
Site 9	UPR Knopcik gas plant
Site 10	Village of Hythe
Site 11	Rigel Knopcik gas plant
Site 12	Rigel battery
Site 13	Crestar Valhalla gas plant (1)
Site 14	AEC West Valhalla battery
Site 15	well sites southeast of Homestead
Site 16	Petro Canada Valhalla gas plant
Site 17	Crestar Valhalla gas plant (2)
Site 18	Crestar Wembley gas plant
Site 19	Peace Pipeline terminal and CCS oil processing facility
Site 20	AEC West Sexsmith gas plant
Site 21	Talisman Teepee Creek gas plant
Site 22	Locality of Teepee Creek
Site 23	Town of Sexsmith

Monitoring Method

The AEP Mobile Air Monitoring Laboratory (MAML) was used to monitor air quality in the County of Grande Prairie on December 1 to 6 and December 10 to 15, inclusive. The MAML is a 27-foot (8.2 m) vehicle that has been specially designed and equipped to measure air quality. It houses a variety of instruments that sample the air at specified time or distance intervals, and analyze the samples quickly and reliably. The MAML is equipped with:

- a dual computer system with a custom program to control the measurement and storage of air samples from each analyzer;
- a GPS (Global Positioning System) that will identify the MAML's location as it moves around Alberta;
- an exhaust scrubbing system that minimizes emissions from the vehicle; and
- two on-board generators that are also equipped with exhaust scrubbers.

The following parameters were measured by the MAML in the County of Grande Prairie:

- sulphur dioxide (SO_2);
- hydrogen sulphide (H_2S);
- total reduced sulphur (TRS);
- total hydrocarbons (THC);
- reactive hydrocarbons (RHC);
- polycyclic aromatic hydrocarbons (PAHs);
- methane (CH_4);
- ozone (O_3);
- nitrogen dioxide (NO_2);

- nitric oxide (NO);
- total oxides of nitrogen (NO_x);
- total suspended particulates (TSP);
- inhalable particulates (PM_{10});
- respirable particulates ($\text{PM}_{2.5}$);
- carbon monoxide (CO);
- ammonia (NH_3);
- wind direction and speed;
- temperature; and
- relative humidity.

In addition to using the MAML, AEP collected air samples using Carbotrap tubes to further identify different types of hydrocarbons when elevated levels were recorded by the MAML. The Carbotrap tube consists of a glass tube 10.6 cm long with a 0.4 cm inside diameter coated internally with an adsorbent media called Carbotrap. Air is passed through this tube at a low flow rate (about 50 to 100 cm^3/min) for a defined period of time, usually 12 to 24 hours. The Carbotrap is specifically formulated to adsorb a number of different hydrocarbon species. The tube then undergoes laboratory analysis by gas chromatography/mass spectroscopy to quantify ambient concentrations of the hydrocarbons of interest. This monitoring method conforms with the U.S. Environmental Protection Agency Compendium Method TO-17. In this study, the Carbotrap tubes were analyzed for benzene, toluene, ethylbenzene and xylenes, often referred to as BTEX. Results of air samples collected using Carbotrap tubes are discussed in the section on hydrocarbons in this report.



Sulphur Dioxide (SO₂)

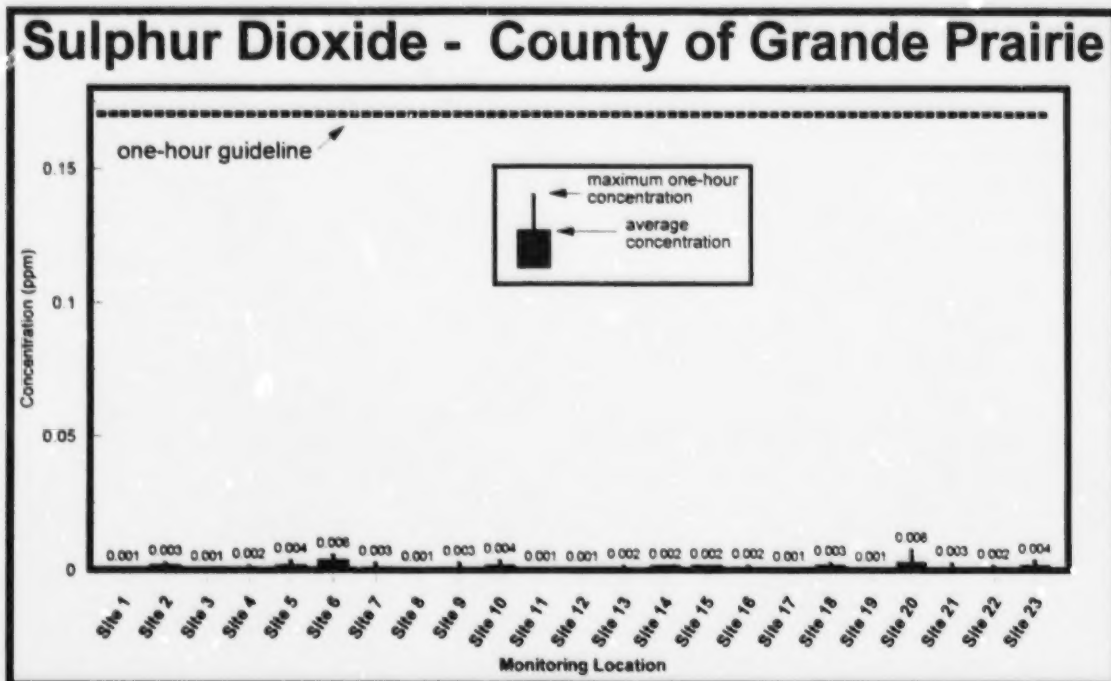
max. one-hour concentration recorded during survey	one-hour guideline
0.008 ppm	0.170 ppm

Sulphur dioxide (SO₂) is a colourless gas with a pungent odour. In Alberta, the major sources of SO₂ are natural gas processing plants, oil sands facilities, and power plants. Other sources include gas plant flares, oil refineries, pulp and paper mills and fertilizer plants.

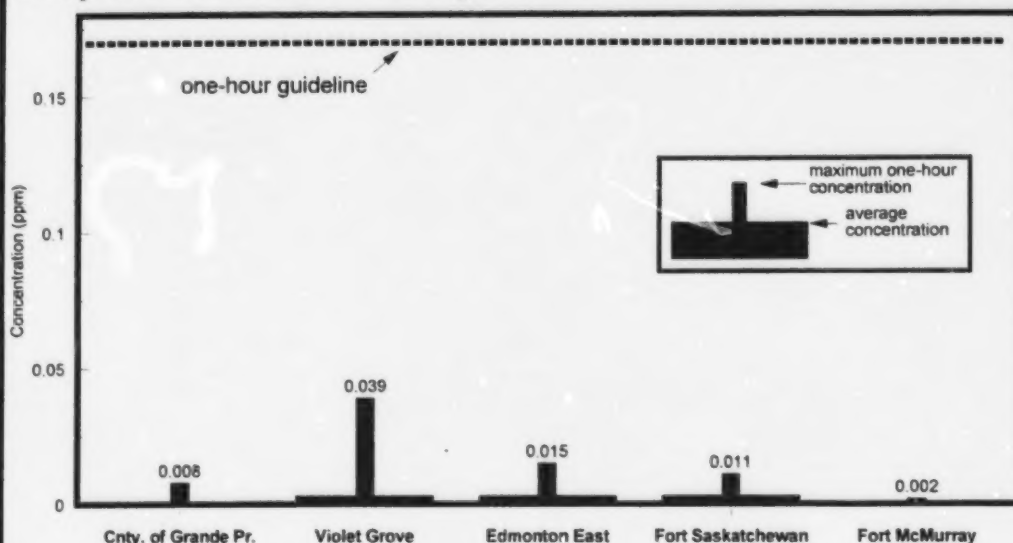
SO₂ concentrations were very low for the entire 12-day monitoring period. The maximum one-hour concentration (0.008 ppm) was measured at Site #20 (located 10 km northeast of La Glace) between 1:45 and 2:45 p.m. on December 11. Winds were from the south with an average speed of 7.3 km/h during this time period. The peak five-minute SO₂ concentration recorded at this time was 0.020 ppm. The second highest one-hour average SO₂ concentration was measured at Site #6 (located 19 km northwest of Hythe) between 11:20 a.m. and 12:20 p.m. on December 15. Winds were from the west-northwest at 11.8 km/h during this time period. The maximum one-

hour and peak five-minute concentrations during this time period were 0.006 and 0.019 ppm, respectively.

Average and maximum SO₂ concentrations for the 12-day monitoring period in the County of Grande Prairie were low compared to other locations in Alberta. The average SO₂ concentration for all 23 sites was 0.001 ppm. This value is low compared to an average value of 0.003 ppm measured at the Edmonton East, Fort Saskatchewan and Violet Grove (located 10 km southwest of Drayton Valley) stations over the same time period. The maximum one-hour SO₂ concentration in the County of Grande Prairie was 0.008 ppm compared to maximum one-hour values of 0.015, 0.011 and 0.039 ppm recorded at the Edmonton East, Fort Saskatchewan and Violet Grove stations, respectively, for the same time period. However, SO₂ levels in the County of Grande Prairie were slightly higher than those recorded at the Fort McMurray station for the 12-day monitoring period. The maximum one-hour concentration recorded for the same time period in Fort McMurray was 0.002 ppm. The Violet Grove station is operated by the West Central Airshed Society (WCAS) and the Fort McMurray station is operated by the Wood Buffalo Environmental Association (WBEA).



Sulphur Dioxide - Comparison with Alberta Locations



Violet Grove is located 10 km southwest of Drayton Valley.

Hydrogen Sulphide and Total Reduced Sulphur (H_2S and TRS)

max. one-hour concentration recorded during survey	one-hour guideline
H_2S = 0.009 ppm TRS = 0.010 ppm	0.010 ppm no guideline

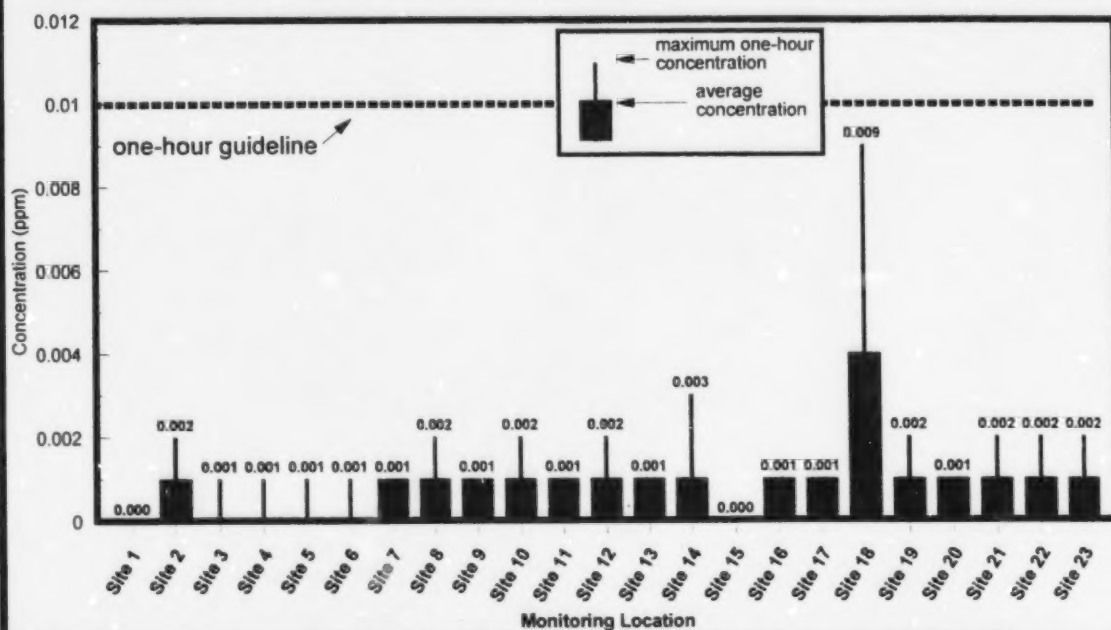
Hydrogen sulphide (H_2S) is a colourless gas with a rotten egg odour. Total reduced sulphur (TRS) includes hydrogen sulphide, mercaptans, carbonyl sulphide, carbon disulphide, dimethyl sulphide, dimethyl disulphide and other sulphur compounds. Sulphur dioxide is not included in the determination of TRS. Industrial sources of H_2S and TRS include fugitive emissions (leakages) from petroleum refineries, tank farms for unrefined petroleum products, natural gas plants, petrochemical plants, oil sands plants, sewage treatment facilities, pulp and paper plants that use the Kraft pulping process, and animal feedlots. Natural sources of H_2S include sulphur hot springs, sloughs, swamps and lakes.

H_2S and TRS concentrations were very low most of the time during the monitoring survey. However, elevated H_2S and TRS levels were measured at Site #18 (located 8 km southwest of La Glace) in the evening on December 1. Elevated levels occurred from 6:30 to 8:40 p.m. at this location. Maximum one-hour average

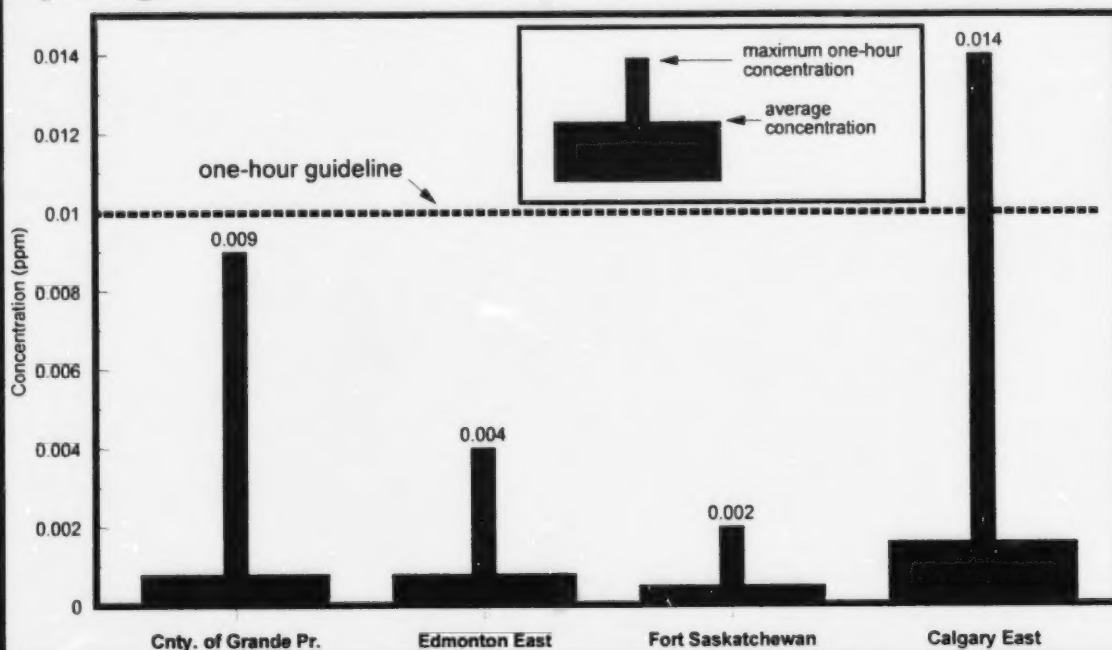
H_2S and TRS values at this time were 0.009 and 0.010 ppm, respectively. Peak five-minute concentrations during this time period for both H_2S and TRS were 0.019 ppm. Winds were light and from variable directions during this episode. Elevated H_2S and TRS concentrations recorded during this event may have been due to fugitive emissions, or leakages, from industrial sources. However, AEP was unable to identify the specific industrial source that caused these elevated H_2S and TRS levels in the area. Concentrations of H_2S and TRS were 0.004 ppm or below for the remainder of the monitoring period. The one-hour guideline for H_2S is 0.010 ppm however, sensitive individuals can detect H_2S as an odour at concentrations as low as 0.003 ppm.

The overall average H_2S concentration in the County of Grande Prairie was close to those recorded at other Alberta locations for the 12-day monitoring period. The maximum one-hour concentration of 0.009 ppm was higher than those recorded at the Edmonton East (0.004 ppm) and Fort Saskatchewan (0.002 ppm) stations, and lower than the maximum one-hour value measured at the Calgary East (0.014 ppm) station. H_2S concentrations do occasionally exceed the one-hour guideline in east Edmonton and Calgary due to emissions from local industrial sources and sewage treatment facilities.

Hydrogen Sulphide - County of Grande Prairie



Hydrogen Sulphide - Comparison with Alberta Locations



Hydrocarbons (THC, RHC and CH₄)

max. one-hour concentration recorded during survey	one-hour guideline
THC = 7.2 ppm RHC = 3.3 ppm CH ₄ = 4.0 ppm	no guideline no guideline no guideline

The term "total hydrocarbons" (THC) refers to a broad family of chemicals that contain carbon and hydrogen atoms. Methane (CH₄), a non-reactive hydrocarbon, is the most common hydrocarbon in the earth's atmosphere. Specific reactive hydrocarbons (RHC) are important because: (1) they can react with oxides of nitrogen in the presence of sunlight to form ozone; and (2) they can be toxic at high concentrations to humans, animals or vegetation. Sources of hydrocarbons include vegetation, vehicular emissions, gasoline marketing and storage tanks, petroleum and chemical industries, dry cleaning, fireplaces, natural gas combustion and aircraft traffic. Some important individual reactive hydrocarbons include benzene, toluene, ethylbenzene and xylenes, often referred to as BTEX. Benzene is a potential cancer causing chemical at high concentrations. BTEX chemicals can be emitted by processes used in the oil and gas industry. Alberta has an interim one-hour guideline for benzene of 30 µg/m³. Air quality guidelines for toluene, ethylbenzene and xylenes in Ontario are 2000, 4000 and 2300 µg/m³, respectively.

Elevated hydrocarbon concentrations were detected at several locations in the County of Grande Prairie. The highest hydrocarbon levels were recorded at Site #13 (located 14 km north of Valhalla Centre in the Saddle Hills) and Site #18 (located 8 km southwest of La Glace). Maximum one-hour THC values at these two locations were 7.2 and 6.8 ppm, respectively. Maximum one-hour THC concentrations at the remaining monitoring locations ranged from 2.1 to 3.9 ppm. THC concentrations in the natural background atmosphere range from 1.5 to 2.0 ppm.

The highest hydrocarbon concentrations were recorded at Site #13 from 5:35 to 6:55 p.m. on December 2. THC, RHC and CH₄ concentrations during this time period were 7.2, 3.3 and 4.0 ppm, respectively. Elevated hydrocarbon concentrations at this location were recorded with light winds (average wind speed of 3.2 km/h) from the east to north-northeast directions. Hydrocarbons recorded during this event were likely due to fugitive emissions from a nearby industrial facility.

Elevated hydrocarbon levels were also recorded at Site #18 between 6:30 and 7:30 p.m. on December 1. H₂S values were also elevated during this time period (refer to previous section on H₂S). Maximum one-hour THC, RHC and CH₄ values during this time period were 6.8, 2.4 and 3.9 ppm, respectively. This event occurred during stagnant weather conditions (light winds and variable wind directions). Elevated hydrocarbon concentrations recorded during this event may have been due to fugitive emissions from industrial sources. However, AEP was unable to identify the specific industrial source that caused these elevated levels.

To further identify the individual hydrocarbon species, an additional air sample was collected using a Carbotrap tube sampling device at Site #18. This air sample was collected from 8:00 p.m. on December 1 to 3:00 p.m. on December 2. Specific hydrocarbon concentrations in this air sample were compared against a background sample collected from 12:15 p.m. on December 1 to 7:15 a.m. on December 2 at Site #8 (located 11 km north-northwest of Hythe). These samples were analyzed for BTEX compounds (benzene, toluene, ethylbenzene and xylenes).

BTEX concentrations were from 3.4 to 6.5 times higher in the air sample collected at Site #18 than in the background sample collected at Site #8. Concentrations of benzene, toluene, ethylbenzene and xylenes were 3.03, 2.67, 0.56 and 2.47 µg/m³, respectively, at Site #18. Concentrations of these chemicals were 0.89, 0.72, 0.09 and 0.52 µg/m³, respectively, in the background sample.

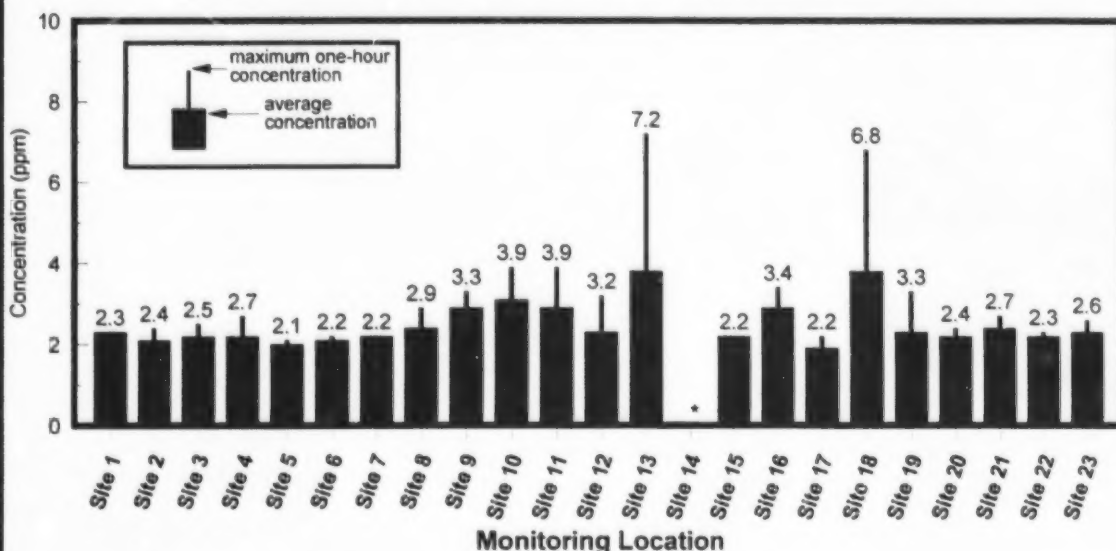
Concentrations of BTEX at Site #18 were slightly higher than typical (median) values recorded in downtown Edmonton and Calgary. However, BTEX concentrations were substantially lower than air quality guidelines and point impingement standards established in Alberta and Ontario. For example, the benzene concentration recorded at Site #18 (3.03 µg/m³) was about 10% of the Alberta interim one-hour guideline for benzene of 30 µg/m³. Concentrations of toluene, ethylbenzene and xylenes were less than 1% of point-impingement air quality standards established for these chemicals in Ontario. Concentrations of BTEX chemicals were also very low compared to occupational exposure levels established by the U.S. Department of Health and Human Services National Institute for Occupational Safety and Health (NIOSH). BTEX levels were also much lower than

published odour thresholds for these chemicals. It should be noted that the Carbotrap air samples were collected over a 19-hour period and air quality guidelines or point impingement standards are based on one, eight and 24-hour averaging times.

The overall average THC concentration in the County of Grande Prairie (2.5 ppm) was close to those recorded at the Edmonton Northwest (2.5 ppm) and Edmonton Central (2.4 ppm) monitoring stations for the same time period. Average THC concentrations at

the Edmonton East (1.9 ppm), Fort Saskatchewan (2.1 ppm) and Fort McMurray (2.0 ppm) stations were somewhat lower than the average value recorded in the County of Grande Prairie. The maximum one-hour THC concentration recorded for this 12-day monitoring period in the County of Grande Prairie was higher than those recorded at other monitoring locations throughout the province. Higher THC values recorded by the MAML in the County of Grande Prairie were due to monitoring in close proximity and directly downwind of industrial facilities in the area.

Total Hydrocarbons - County of Grande Prairie



Natural background total hydrocarbon concentrations are from 1.5 to 2.0 ppm.

* Indicates data not available due to interference from MAML exhaust.

Individual Hydrocarbon Species Concentrations in the County of Grande Prairie (ug/m ³)								
Hydrocarbon Species	Site #8 ^a	Site #18 ^b	Median Concentration from 1991 to 1997			Air Quality Guideline	Occupation Exposure Limit	Odour Threshold ^h
			Edmonton Central	Edmonton East	Calgary Central			
Benzene	0.89	3.03	2.65	2.03	2.94	30 ^c	320 ^f	4500
Toluene	0.72	2.67	1.31	0.71	1.21	2000 ^g	375000 ^g	8025
Ethyl Benzene	0.09	0.56	6.31	3.93	6.75	4000 ^g	435000 ^g	8700
Xylenes	0.52	2.47	6.21	3.52	6.00	2300 ^d	435000 ^g	348

a Based on one 19 hour sample collected from 12:15 p.m. on December 1 to 7:15 a.m. on December 2.

b Based on one 19 hour sample collected from 8:00 p.m. on December 1 to 3:00 p.m. on December 2.

c One-hour interim air quality guideline for Alberta.

d 24-hour point of impingement standard (Ontario Ministry of the Environment and Energy).

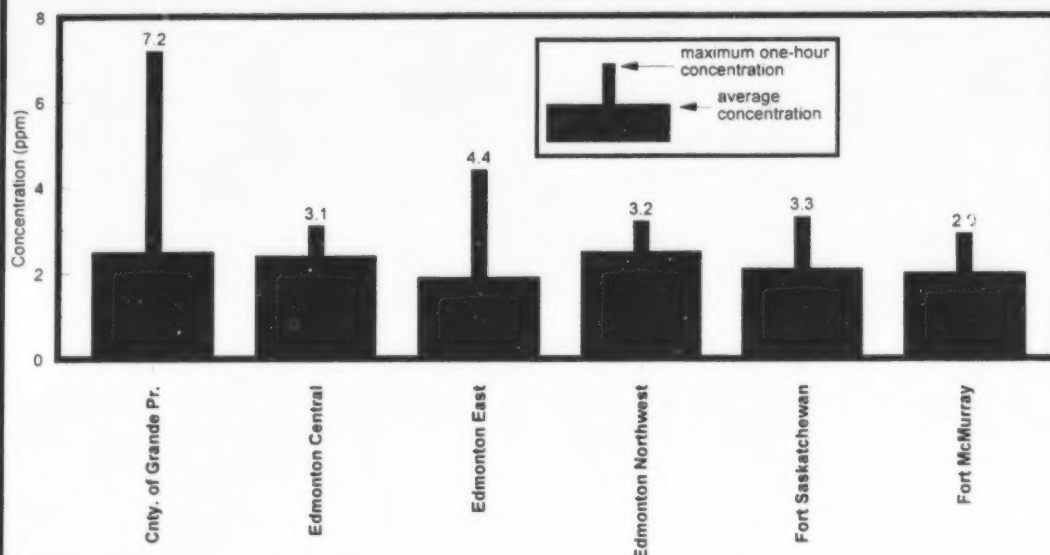
e One-hour point of impingement standard (Ontario Ministry of the Environment and Energy).

f Eight-hour recommended exposure limit (U.S. Department of Health and Human Services National Institute for Occupational Safety and Health).

g Eight-hour permissible exposure limit (U.S. Department of Health and Human Services National Institute for Occupational Safety and Health).

h Odour thresholds are from "Odour thresholds and irritation levels of several chemical substances: a review", 1986, Am. Ind. Hyg. Assoc. J. (47).

Total Hydrocarbons - Comparison with Alberta Locations



Natural background total hydrocarbon concentrations are from 1.5 to 2.0 ppm.

Ozone (O_3)

max. one-hour concentration recorded during survey	one-hour guideline
0.043 ppm	0.082 ppm

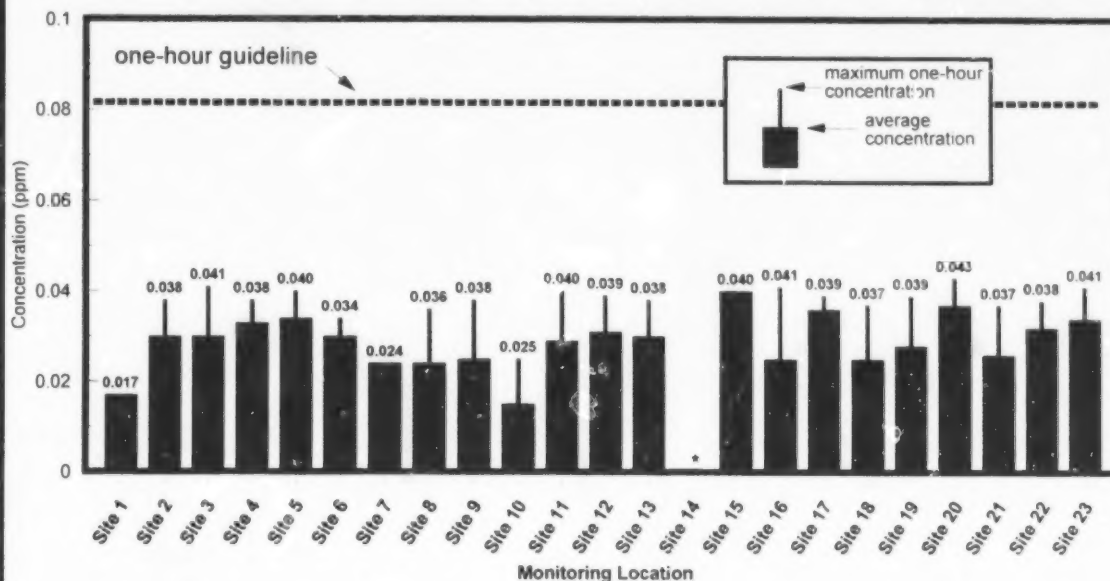
Ozone in the lower atmosphere is produced by: (1) the reaction of oxides of nitrogen and volatile organic compounds in the presence of sunlight; and (2) transport of O_3 from the upper atmosphere to ground level. Transport from the upper atmosphere is likely the dominant ozone producing process in the winter season. O_3 concentrations are generally lower in urban centres due to the destruction of O_3 by nitric oxide. O_3 values are also generally lowest in the fall and winter seasons.

O_3 concentrations followed the typical daily variations in the County of Grande Prairie that are observed at other locations in Alberta. The lowest concentrations were generally recorded in the early morning or late evening with the highest concentrations measured in mid-afternoon. The maximum one-hour average concentration (0.043 ppm) was recorded from 1:45 to 2:50 p.m. on December 11 at Site #20, located 10 km northeast of La Glace. One-hour average O_3 concentrations near 0.040 ppm were also recorded in the afternoon on December 6, 10, 13, 14 and 15. Maximum one-hour O_3 values were in the 0.020 and

0.030 ppm range on the remaining survey days. Higher O_3 concentrations usually corresponded with higher wind speeds. For example, maximum hourly wind speeds ranged from 7 to 34 km/h on days with higher O_3 values (concentrations near 0.040 ppm) compared to wind speeds from 3 to 13 km/hr on days with lower O_3 concentrations. O_3 values were higher on windy days because of more mixing with the O_3 rich upper atmosphere. The major source of O_3 during the winter season is transport of natural O_3 from the upper atmosphere.

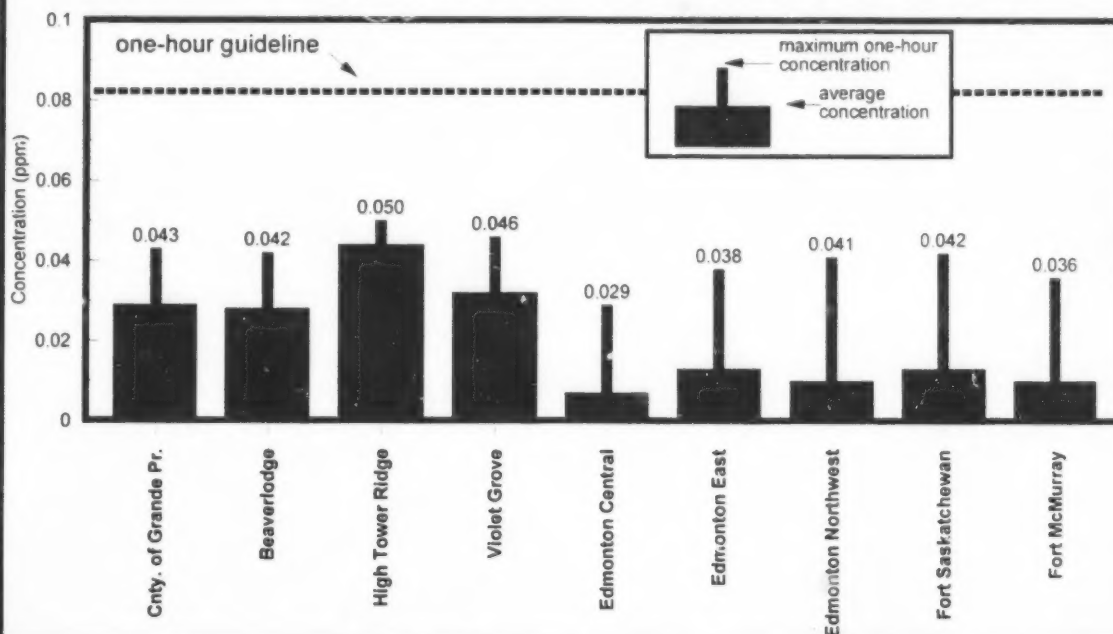
O_3 concentrations in the County of Grande Prairie were similar to those recorded at other rural locations in Alberta for the same time period. The average O_3 value in the County of Grande Prairie was 0.029 ppm which is close to that recorded at the AEP Beaverlodge (0.028 ppm) and WCAS Violet Grove (0.032 ppm) stations for the same time period. However, O_3 values in the County of Grande Prairie were lower than those recorded at the WCAS Hightower Ridge station (located 65 km west-northwest of Hinton) where the average value was 0.044 ppm. Lower O_3 concentrations were observed at locations influenced by urban sources such as vehicle exhaust emissions (Edmonton, Fort Saskatchewan and Fort McMurray). As mentioned earlier, nitric oxide emitted by vehicles will destroy O_3 that is naturally present in the atmosphere.

Ozone - County of Grande Prairie



* Indicates data not available due to interference from MAML exhaust.

Ozone - Comparison with Alberta Locations



Oxides of Nitrogen (NO_2 , NO , NO_x)

max. one-hour concentration recorded during survey	one-hour guideline
$\text{NO}_2 = 0.019 \text{ ppm}$	0.210 ppm
$\text{NO} = 0.027 \text{ ppm}$	no guideline
$\text{NO}_x = 0.040 \text{ ppm}$	no guideline

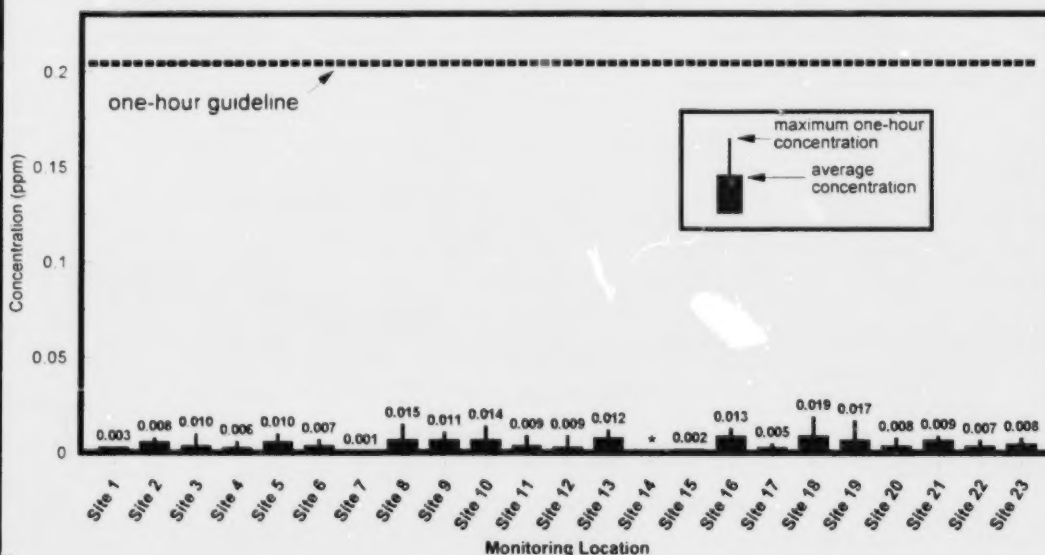
Oxides of nitrogen (NO_x) are the total of nitrogen dioxide (NO_2) and nitric oxide (NO). During high temperature combustion - as in the burning of natural gas, coal, oil and gasoline - atmospheric nitrogen may combine with molecular oxygen to form NO . NO is colourless and odourless. Most NO in the ambient air is oxidized to form NO_2 . NO_2 is a reddish-brown gas with a pungent odour. The major source of oxides of nitrogen in urban areas is vehicle exhaust emissions. Processes associated with the oil and gas industry also emit oxides of nitrogen into the atmosphere.

The maximum one-hour average NO_2 concentration was recorded at Site #18 (located 8 km southwest of La Glace) on December 1 from 6:30 to 7:30 p.m. The one-hour average concentration recorded at this time

(0.019 ppm) was only 9% of the one-hour guideline (0.210 ppm). One-hour average NO_2 concentrations of 0.015 and 0.017 ppm were recorded earlier in the day on December 1 at Site #8 (located 11 km north-northwest of Hythe) and at Site #19 (located 10 km southwest of La Glace), respectively. Hourly NO_2 values were below 0.015 ppm for the remainder of the monitoring period at all locations. The highest NO concentrations were recorded in Hythe during the morning on December 6 (0.027 ppm) and at Site #8 near noon on December 1 (0.025 ppm).

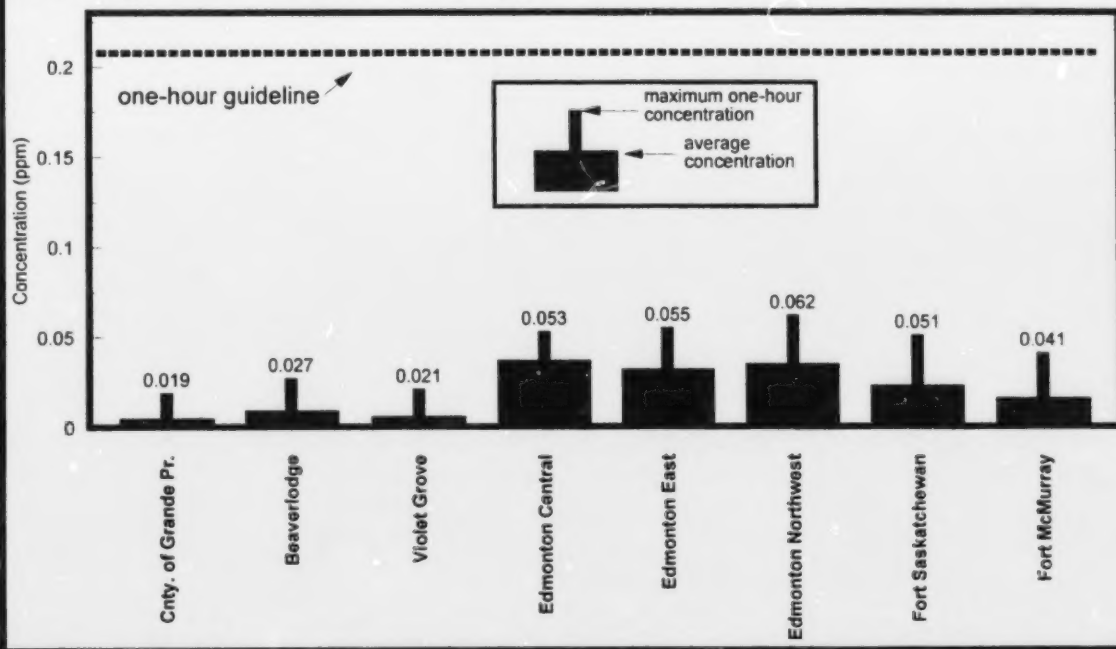
Oxides of nitrogen concentrations were low compared to urban locations in the province. The overall average NO_2 concentration in the County of Grande Prairie was 0.005 ppm compared to average values ranging from 0.016 to 0.037 ppm for the same time period at stations located in Edmonton, Fort McMurray and Fort Saskatchewan. The average NO_2 concentration in the County of Grande Prairie was similar to those recorded at rural stations located near Beaverlodge (0.009 ppm) and Violet Grove (0.006 ppm).

Nitrogen Dioxide - County of Grande Prairie



* Indicates data not available due to interference from MAML exhaust.

Nitrogen Dioxide - Comparison with Alberta Locations



Carbon Monoxide (CO)

max. one-hour concentration recorded during survey	one-hour guideline
0.6 ppm	13 ppm

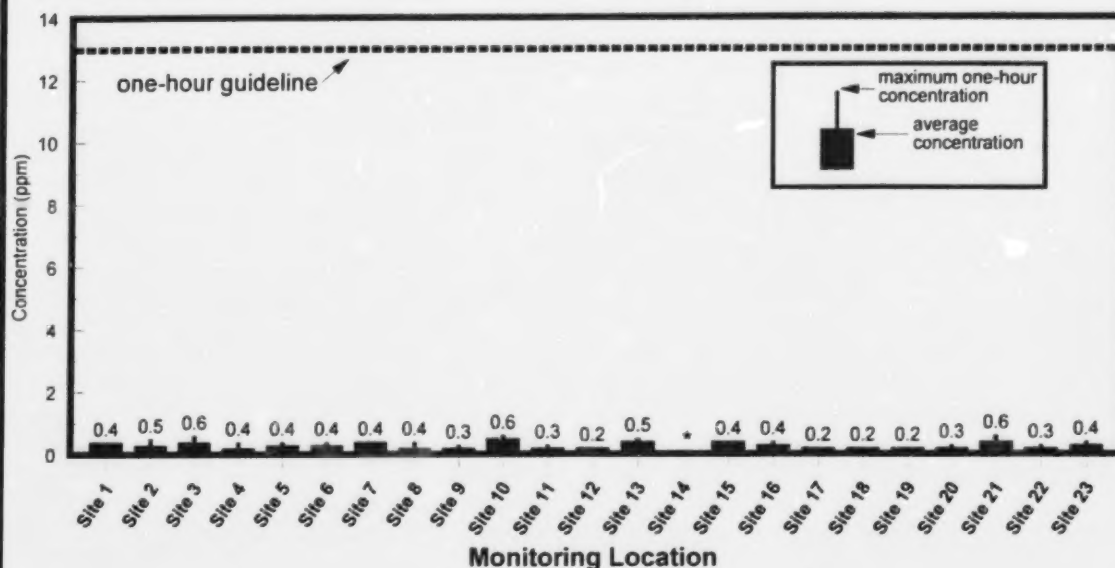
Carbon monoxide is a colourless, odourless gas emitted into the atmosphere primarily by motor vehicles. Minor sources include fireplaces, industry, aircraft and natural gas combustion.

Carbon monoxide values were very low on all 12 survey days in the County of Grande Prairie. The maximum one-hour concentration of 0.6 ppm was recorded while monitoring at Site #21 (located 5 km west of Teepee Creek) on December 2, at Site #10 (in

Hythe) on December 6 and at Site #3 (located 2.5 km southeast of Goodfare) on December 15. This maximum value is only 5% of the one-hour guideline of 13 ppm for carbon monoxide.

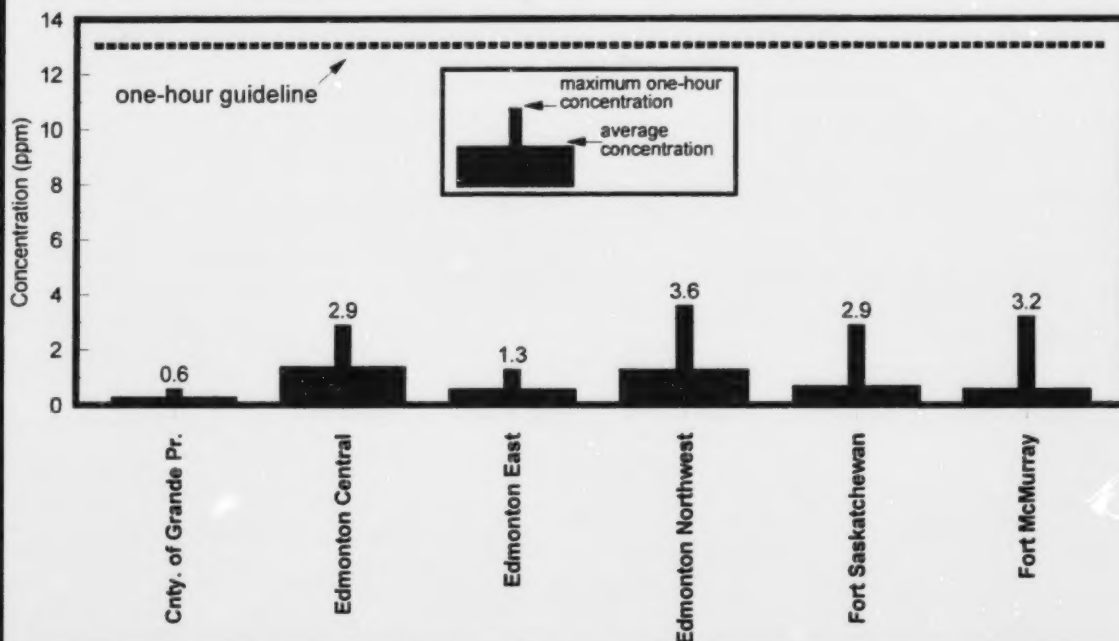
Carbon monoxide values in the County of Grande Prairie were much lower than in urban locations across the province. The average CO concentration during the County of Grande Prairie survey was 0.3 ppm compared to average values ranging from 0.6 to 1.4 ppm in Edmonton, Fort McMurray and Fort Saskatchewan for the same monitoring period. CO is not routinely monitored at rural locations in Alberta. The major source of CO is vehicle exhaust emissions. CO is also emitted during combustion processes associated with the oil and gas industry.

Carbon Monoxide - County of Grande Prairie



* Indicates data not available due to interference from MAML exhaust.

Carbon Monoxide - Comparison with Alberta Locations



Particulates (TSP, PM₁₀ and PM_{2.5})

max. one-hour concentration recorded during survey	one-hour guideline
TSP = 106 µg/m ³	no guideline
PM ₁₀ = 47 µg/m ³	no guideline
PM _{2.5} = 6 µg/m ³	no guideline

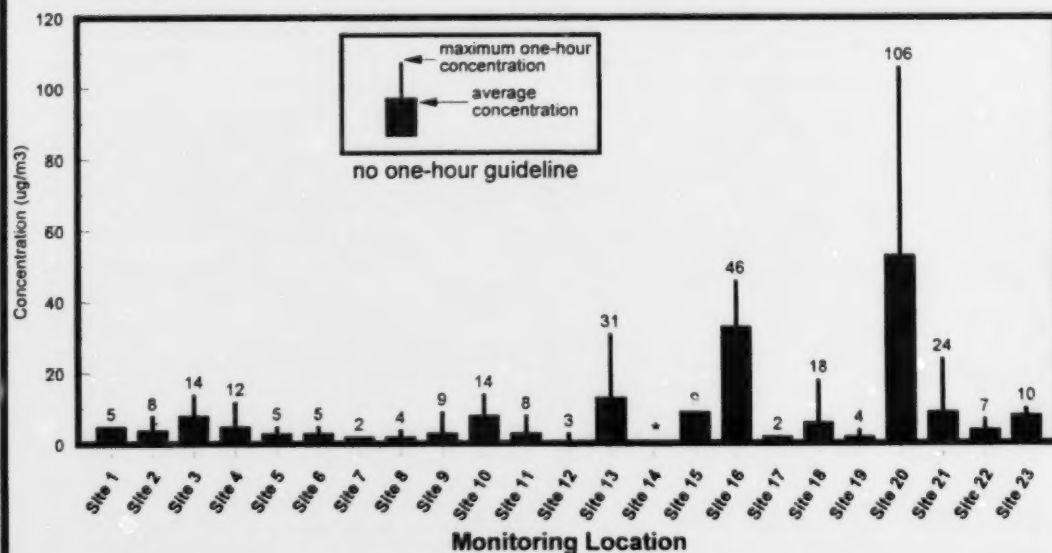
Air pollutants are not necessarily in a gaseous form. Tiny particles of solid material or liquid droplets, defined collectively as particulates are also present in the atmosphere. Total suspended particulates (TSP) refers to all particles up to 500 microns in diameter (a human hair is about 100 microns in diameter) and are important primarily from a nuisance perspective. Particles less than 10 microns in diameter (PM₁₀) can be inhaled into the nose and throat while particles less than 2.5 microns in diameter (PM_{2.5}) can penetrate into the lungs. Particulate sources include soil dust, road dust, agricultural dust (for example harvest), smoke from forest fires and recreational wood burning, vehicle exhaust emissions, brake and tire wear, and industrial emissions. Smaller particles (PM_{2.5}) originate in the atmosphere because of condensation and combustion from sources such as vehicle exhaust emissions, industrial emissions and wood burning.

The highest particulate concentrations during the 12-day survey were recorded at Site #20 (located 10 km northeast of La Glace) from 1:45 to 2:45 p.m. on

December 14. TSP (total suspended particulate) and PM₁₀ (inhalable particulate) concentrations during this time period were 106 and 47 µg/m³, respectively. These elevated particulate concentrations were caused by truck traffic along Secondary Highway 724. Elevated TSP values were also recorded at Site #20 on December 2, and at Site #16 (located 11 km northeast of Valhalla Centre) on December 2 and 5. PM₁₀ concentrations during these times were between 20 and 28 µg/m³. Elevated TSP and PM₁₀ values in the County of Grande Prairie were due to dust from vehicle traffic along roads that were not snow covered. PM_{2.5} (respirable particulate) concentrations were very low during the entire monitoring period with a maximum one-hour concentration of 6 µg/m³.

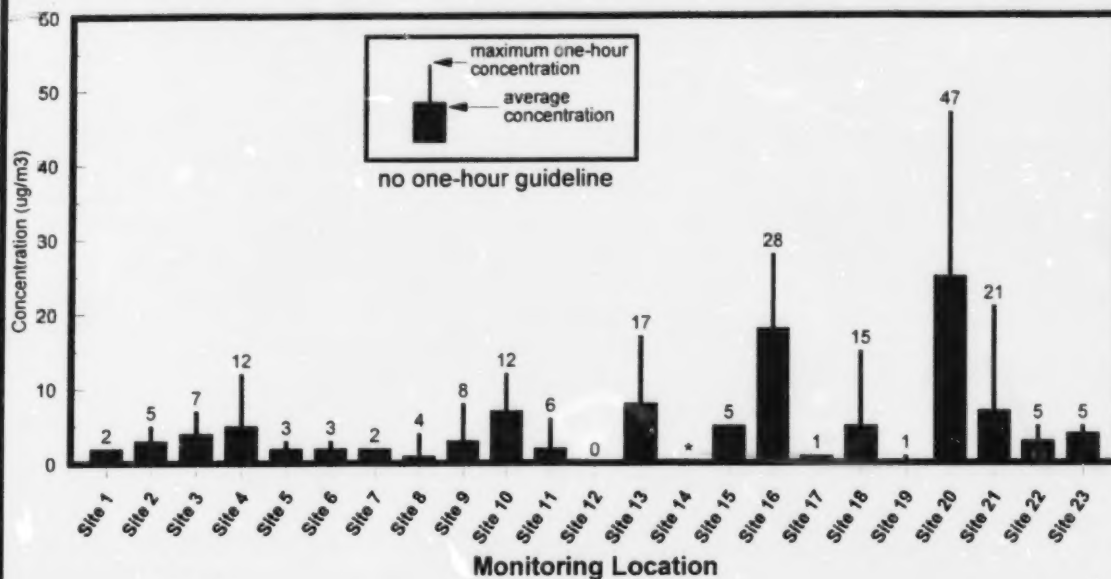
Particulate concentrations in the County of Grande Prairie were low compared to those for urban locations in Alberta. The overall average PM₁₀ and PM_{2.5} concentrations in the County of Grande Prairie were 5 and 1 µg/m³, respectively. These values are much lower than the average PM₁₀ (24 µg/m³) and PM_{2.5} (17 µg/m³) concentrations measured at Edmonton monitoring stations for the same time period. TSP is not continuously monitored on a routine basis at other locations in Alberta. However, TSP is monitored as a 24-hour concentration at several locations in the province.

Total Suspended Particulates - County of Grande Prairie



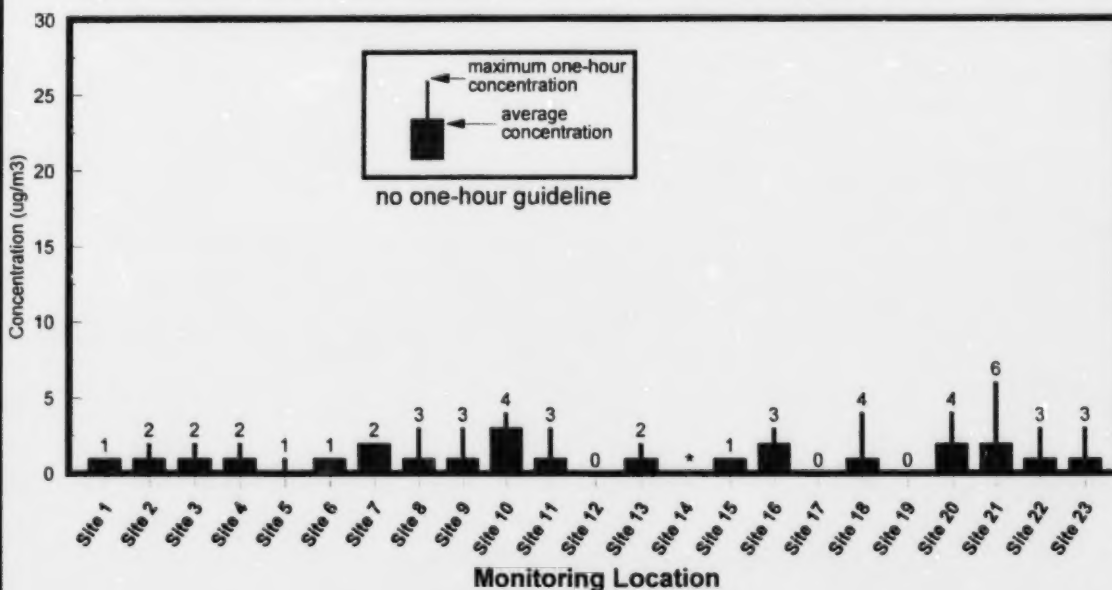
* Indicates data not available due to interference from MAML exhaust.

Inhalable Particulates (PM10) - County of Grande Prairie



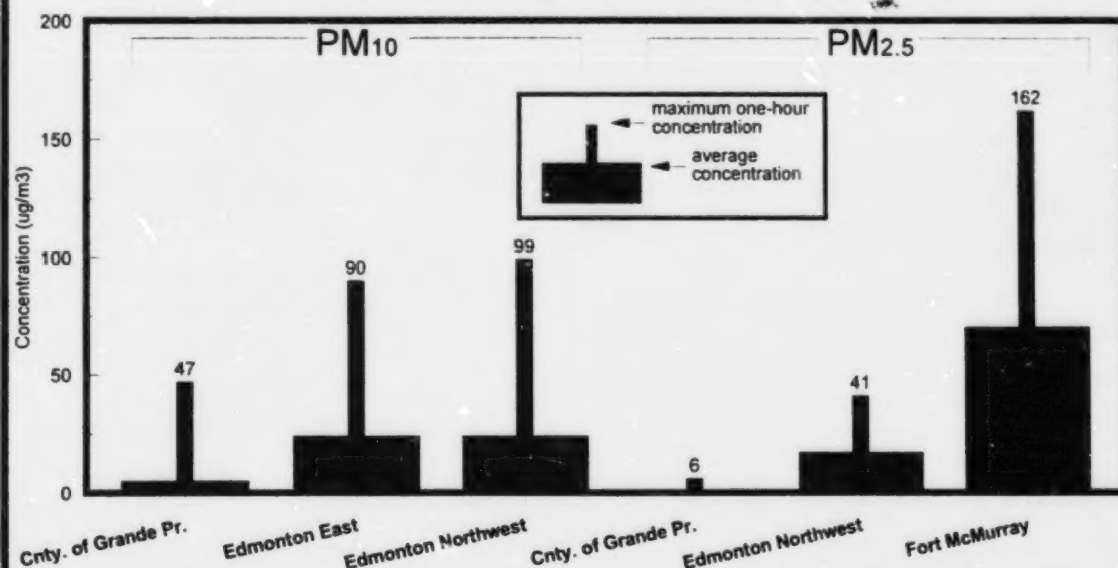
* Indicates data not available due to interference from MAML exhaust.

Respirable Particulates (PM2.5) - County of Grande Prairie



* Indicates data not available due to interference from MAML exhaust.

Inhalable (PM₁₀) and Respirable (PM_{2.5}) Particulates Comparison with Alberta Locations



Polycyclic Aromatic Hydrocarbons (PAHs)

max. one-hour concentration recorded during survey	one-hour guideline
12 ng/m ³	no guideline

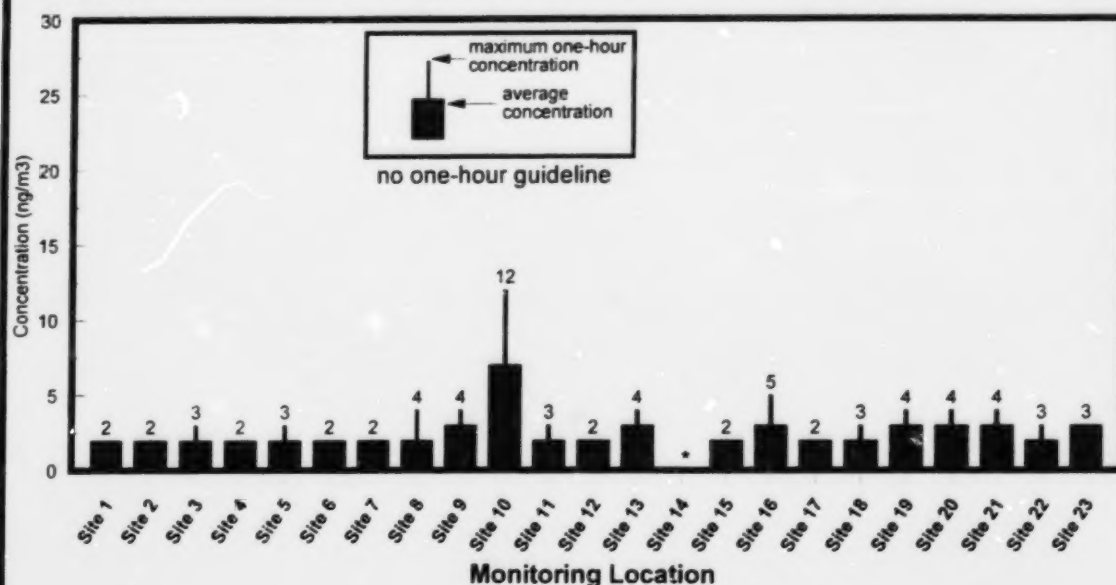
Polycyclic aromatic hydrocarbons (PAHs) are a class of chemicals that are contained in soot and smoke. There are more than 100 different PAHs with varying levels of toxicity. They are formed during the incomplete combustion of gasoline, diesel, oil, coal, wood, garbage or other organic substances. Tobacco smoke and charbroiled meats are common sources of PAHs. Other outdoor PAH sources include vehicle exhaust emissions, wood smoke from fireplaces, smoke from forest fires and industrial facilities.

The highest one-hour average PAH concentration was recorded at Site #10 (in Hythe) from 10:15 to

11:15 a.m. on December 6. This slightly elevated value was due to vehicle exhaust emissions in the Village of Hythe. PAH levels were very low for the remainder of the monitoring period. One-hour average concentrations were 5 ng/m³ or less on the remaining survey days.

Alberta does not have ambient air quality guidelines for total PAHs. However, the maximum one-hour PAH concentration of 12 ng/m³ was much lower than the NIOSH permissible exposure level for total PAHs (100,000 ng/m³ for a 10 hour exposure period). PAHs are not routinely monitored on an hourly basis at other locations in Alberta. However, PAHs are monitored as a 24-hour concentration at several locations in the province.

Polycyclic Aromatic Hydrocarbons - County of Grande Prairie



* Indicates data not available due to interference from MAML exhaust.

Ammonia (NH₃)

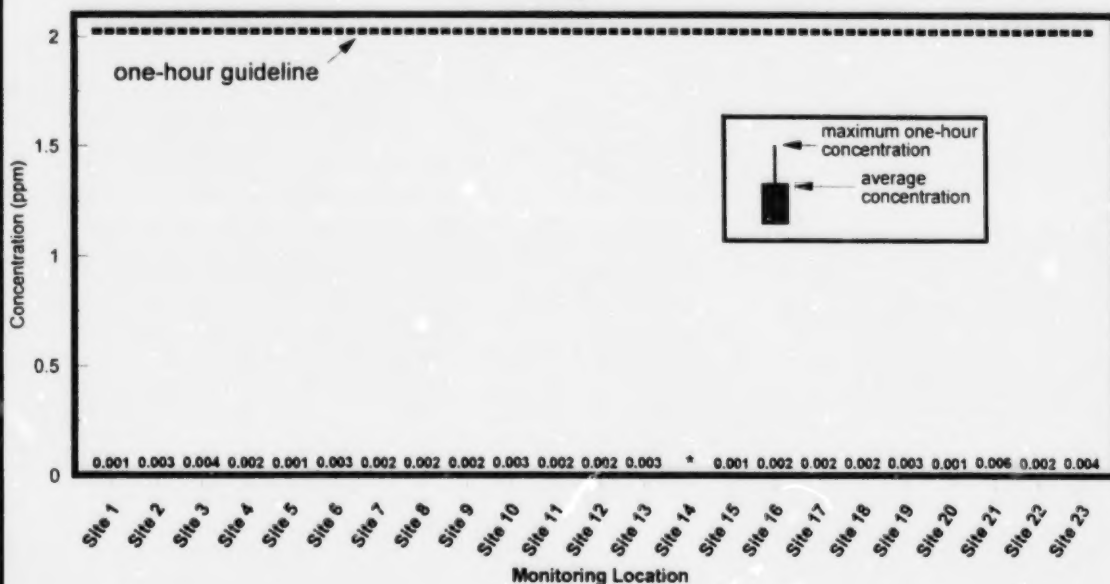
max. one-hour concentration recorded during survey	one-hour guideline
0.006 ppm	2.0 ppm

Ammonia is a colourless gas with the well-known pungent odour found in household cleaners. NH₃ is produced both by natural and man-made sources. Some natural sources of NH₃ include the decay of plant and animal material, animal waste. A small portion is also released during respiration. In Alberta, the fertilizer industry is the main industrial source of NH₃. The industry produces synthetic NH₃ for either direct application to soil as a fertilizer, or as a raw material for use in the production of other high nitrogen fertilizer products. The other major source of NH₃ is commercial feedlots, specifically from their large amounts of animal waste.

NH₃ concentrations were very low during the County of Grande Prairie monitoring survey. The highest one-hour average NH₃ concentration was measured from 11:15 a.m. and 12:20 p.m. on December 2 at Site #21, located 5 km west of Teepee Creek. The maximum value recorded at this time (0.006 ppm) was negligible compared to the one-hour guideline of 2.0 ppm.

Average and maximum one-hour NH₃ values in the County of Grande Prairie were 0.001 and 0.006 ppm, respectively. These values are very low compared to average (0.006 ppm) and maximum one-hour (0.027 ppm) concentrations measured at the Fort Saskatchewan station for the same time period. NH₃ is not continuously monitored at any other locations in the province by AEP.

Ammonia - County of Grande Prairie



* Indicates data not available due to interference from MAML exhaust.

Ammonia - Comparison with Alberta Locations

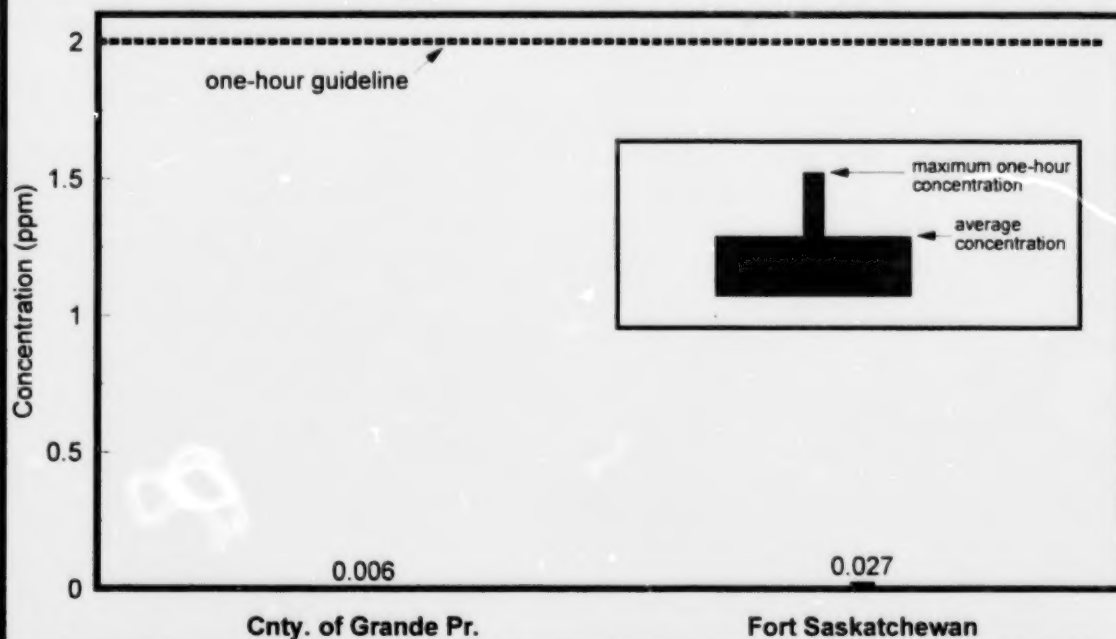


Table 1 shows **average** air quality parameter concentrations at individual monitoring locations in the County of Grande Prairie for the monitoring period (December 1 to 15, 1998).

Monitoring Location	CO (ppm)	O ₃ (ppm)	THC (ppm)	CH ₄ (ppm)	RHC (ppm)	SO ₂ (ppm)	NO (ppm)	NO ₂ (ppm)	NO _x (ppm)	NH ₃ (ppm)	TRS (ppm)	H ₂ S (ppm)	TSP (ug/m ³)	PM ₁₀ (ug/m ³)	PM _{2.5} (ug/m ³)	PAH (ng/m ³)
Site #1	0.4	0.017	2.3	1.8	0.5	0.001	0.000	0.003	0.002	0.001	0.000	0.000	5	2	1	2
Site #2	0.3	0.030	2.1	1.7	0.3	0.002	0.003	0.006	0.008	0.002	0.001	0.001	4	3	1	2
Site #3	0.4	0.030	2.2	1.8	0.3	0.001	0.003	0.004	0.007	0.002	0.000	0.000	8	4	1	2
Site #4	0.2	0.033	2.2	1.8	0.3	0.001	0.001	0.003	0.003	0.001	0.000	0.000	5	5	1	2
Site #5	0.3	0.034	2.0	1.6	0.3	0.002	0.001	0.006	0.006	0.001	0.000	0.000	3	2	0	2
Site #6	0.3	0.030	2.1	1.8	0.3	0.004	0.003	0.004	0.007	0.002	0.000	0.000	3	2	1	2
Site #7	0.4	0.024	2.2	1.8	0.3	0.001	0.006	0.001	0.007	0.002	0.000	0.001	2	2	2	2
Site #8	0.2	0.024	2.4	1.9	0.4	0.001	0.010	0.007	0.017	0.002	0.001	0.001	2	1	1	2
Site #9	0.2	0.025	2.9	2.0	0.7	0.001	0.011	0.007	0.017	0.001	0.001	0.001	3	3	1	3
Site #10	0.5	0.015	3.1	2.4	0.5	0.002	0.016	0.007	0.024	0.003	0.001	0.001	8	7	3	7
Site #11	0.2	0.029	2.9	2.1	0.7	0.001	0.006	0.004	0.010	0.001	0.001	0.001	3	2	1	2
Site #12	0.2	0.031	2.3	1.9	0.4	0.001	0.007	0.003	0.010	0.001	0.001	0.001	1	0	0	2
Site #13	0.4	0.030	3.8	2.5	1.3	0.001	0.005	0.008	0.013	0.001	0.001	0.001	13	8	1	3
Site #14	*	*	*	*	0.7	0.002	*	*	*	*	0.001	0.001	*	*	*	*
Site #15	0.4	0.040	2.2	1.7	0.5	0.002	0.000	0.002	0.001	0.001	0.000	0.000	9	5	1	2
Site #16	0.3	0.025	2.9	2.2	0.5	0.001	0.004	0.009	0.012	0.001	0.000	0.001	33	18	2	3
Site #17	0.2	0.036	1.9	1.5	0.4	0.001	0.002	0.003	0.004	0.002	0.001	0.001	2	1	0	2
Site #18	0.2	0.025	3.8	2.6	1.0	0.002	0.004	0.009	0.013	0.002	0.004	0.004	6	5	1	2
Site #19	0.2	0.028	2.3	1.8	0.5	0.001	0.003	0.007	0.010	0.001	0.001	0.001	2	0	0	3
Site #20	0.2	0.037	2.2	1.8	0.3	0.003	0.003	0.004	0.006	0.001	0.000	0.001	53	25	2	3
Site #21	0.4	0.026	2.4	2.0	0.4	0.001	0.005	0.007	0.011	0.002	0.001	0.001	9	7	2	3
Site #22	0.2	0.032	2.2	1.8	0.3	0.001	0.003	0.004	0.007	0.001	0.001	0.001	4	3	1	2
Site #23	0.3	0.034	2.3	1.8	0.3	0.002	0.004	0.005	0.008	0.002	0.000	0.001	8	4	1	3
Overall Average	0.3	0.029	2.5	1.9	0.5	0.001	0.005	0.005	0.009	0.001	0.001	0.001	8	5	1	2

* Less than 75% of data available for one hour period due to interference from MAML generator exhaust.

Table 2 shows **maximum one-hour** air quality parameter concentrations at individual monitoring locations in the County of Grande Prairie for the monitoring period (December 1 to 15, 1998).

Monitoring Location	CO (ppm)	O ₃ (ppm)	THC (ppm)	CH ₄ (ppm)	RHC (ppm)	SO ₂ (ppm)	NO (ppm)	NO ₂ (ppm)	NO _x (ppm)	NH ₃ (ppm)	TRS (ppm)	H ₂ S (ppm)	TSP (ug/m ³)	PM ₁₀ (ug/m ³)	PM _{2.5} (ug/m ³)	PAH (ng/m ³)
Site #1	0.4	0.017	2.3	1.8	0.5	0.001	0.000	0.003	0.002	0.001	0.000	0.000	5	2	1	2
Site #2	0.5	0.038	2.4	1.9	0.7	0.003	0.008	0.008	0.017	0.003	0.001	0.002	8	5	2	2
Site #3	0.6	0.041	2.5	1.9	0.7	0.001	0.006	0.010	0.014	0.004	0.001	0.001	14	7	2	3
Site #4	0.4	0.038	2.7	2.1	0.7	0.002	0.002	0.006	0.007	0.002	0.001	0.001	12	12	2	2
Site #5	0.4	0.040	2.1	1.7	0.5	0.004	0.002	0.010	0.012	0.001	0.001	0.001	5	3	1	3
Site #6	0.4	0.034	2.2	1.8	0.4	0.006	0.007	0.007	0.011	0.003	0.001	0.001	5	3	1	2
Site #7	0.4	0.024	2.2	1.8	0.3	0.003	0.006	0.001	0.007	0.002	0.001	0.001	2	2	2	2
Site #8	0.4	0.036	2.9	2.2	0.6	0.001	0.025	0.015	0.040	0.002	0.001	0.002	4	4	3	4
Site #9	0.3	0.038	3.3	2.4	1.2	0.003	0.016	0.011	0.024	0.002	0.001	0.001	9	8	3	4
Site #10	0.6	0.025	3.9	3.0	0.8	0.004	0.027	0.014	0.040	0.003	0.001	0.002	14	12	4	12
Site #11	0.3	0.040	3.9	2.8	1.0	0.001	0.009	0.009	0.016	0.002	0.001	0.001	8	6	3	3
Site #12	0.2	0.039	3.2	2.7	0.5	0.001	0.016	0.009	0.025	0.002	0.001	0.002	3	0	0	2
Site #13	0.5	0.038	7.2	4.0	3.3	0.002	0.015	0.012	0.027	0.003	0.001	0.001	31	17	2	4
Site #14	*	*	*	*	*	0.002	*	*	*	*	0.002	0.003	*	*	*	*
Site #15	0.4	0.040	2.2	1.7	0.5	0.002	0.000	0.002	0.001	0.001	0.000	0.000	9	5	1	2
Site #16	0.4	0.041	3.4	2.5	0.9	0.002	0.005	0.013	0.018	0.002	0.001	0.001	46	28	3	5
Site #17	0.2	0.039	2.2	1.9	0.4	0.001	0.003	0.005	0.006	0.002	0.002	0.001	2	1	0	2
Site #18	0.2	0.037	6.8	3.9	2.4	0.003	0.008	0.019	0.026	0.002	0.010	0.009	18	15	4	3
Site #19	0.2	0.039	3.3	2.5	0.7	0.001	0.006	0.017	0.023	0.003	0.002	0.002	4	1	0	4
Site #20	0.3	0.043	2.4	2.0	0.4	0.008	0.006	0.008	0.014	0.001	0.001	0.001	106	47	4	4
Site #21	0.6	0.037	2.7	2.2	0.4	0.003	0.015	0.009	0.024	0.006	0.002	0.002	24	21	6	4
Site #22	0.3	0.038	2.3	1.9	0.4	0.002	0.003	0.007	0.008	0.002	0.001	0.002	7	5	3	3
Site #23	0.4	0.041	2.6	2.2	0.4	0.004	0.010	0.008	0.018	0.004	0.001	0.002	10	5	3	3
One-hour Maximum	0.6	0.043	7.2	4.0	3.3	0.008	0.027	0.019	0.040	0.006	0.010	0.009	106	47	6	12
One-Hour Guideline	13.0	0.082	n/a	n/a	n/a	0.170	n/a	0.210	n/a	2.000	n/a	0.010	n/a	n/a	n/a	n/a

* Less than 75% of data available for one hour period due to interference from MAML generator exhaust.

Table 3 shows **peak five-minute** air quality parameter concentrations at individual monitoring locations in the County of Grande Prairie for the monitoring period (December 1 to 15, 1998).

Monitoring Location	CO (ppm)	O ₃ (ppm)	THC (ppm)	CH ₄ (ppm)	RHC (ppm)	SO ₂ (ppm)	NO (ppm)	NO ₂ (ppm)	NO _x (ppm)	NH ₃ (ppm)	TRS (ppm)	H ₂ S (ppm)	TSP (ug/m ³)	PM ₁₀ (ug/m ³)	PM _{2.5} (ug/m ³)	PAH (ng/m ³)
Site #1	1.6	0.019	2.4	2.1	0.5	0.001	0.002	0.003	0.004	0.002	0.000	0.000	12	6	1	2
Site #2	0.6	0.039	2.9	2.0	1.5	0.004	0.011	0.014	0.025	0.007	0.002	0.002	11	7	2	3
Site #3	0.9	0.041	3.2	2.1	1.1	0.002	0.016	0.019	0.035	0.024	0.001	0.001	44	21	3	4
Site #4	0.7	0.039	2.9	2.2	0.7	0.004	0.008	0.007	0.010	0.003	0.002	0.002	14	10	2	4
Site #5	0.8	0.040	2.6	2.4	0.6	0.005	0.015	0.018	0.023	0.016	0.002	0.002	97	55	8	4
Site #6	0.9	0.037	2.7	2.0	0.5	0.019	0.022	0.016	0.038	0.004	0.001	0.001	19	7	1	5
Site #7	0.8	0.036	2.3	1.8	0.3	0.003	0.009	0.004	0.012	0.007	0.001	0.001	10	4	2	2
Site #8	0.7	0.039	3.4	2.3	0.7	0.001	0.046	0.022	0.068	0.003	0.002	0.003	5	4	3	13
Site #9	0.4	0.039	4.5	2.7	2.7	0.004	0.030	0.014	0.041	0.004	0.002	0.002	14	13	4	7
Site #10	0.9	0.026	4.0	3.1	0.9	0.005	0.038	0.030	0.062	0.006	0.002	0.002	31	21	5	62
Site #11	0.5	0.040	4.2	2.9	1.9	0.002	0.011	0.011	0.018	0.002	0.002	0.002	9	8	3	4
Site #12	0.5	0.040	4.5	4.0	1.1	0.002	0.017	0.012	0.028	0.003	0.002	0.002	6	6	3	4
Site #13	0.8	0.042	10.6	5.6	7.0	0.004	0.025	0.024	0.045	0.005	0.002	0.002	63	31	2	4
Site #14	0.5	0.035	2.5	2.0	0.7	0.004	0.003	0.007	0.010	0.004	0.004	0.004	7	5	1	4
Site #15	0.5	0.040	2.4	1.7	0.6	0.003	0.000	0.003	0.001	0.002	0.002	0.000	16	9	1	3
Site #16	0.5	0.042	4.8	2.9	1.7	0.003	0.008	0.017	0.024	0.004	0.002	0.002	391	235	18	8
Site #17	0.4	0.039	4.9	2.9	2.1	0.003	0.011	0.016	0.024	0.004	0.002	0.002	44	28	4	6
Site #18	0.8	0.038	11.2	5.6	4.8	0.004	0.014	0.028	0.038	0.004	0.019	0.019	93	80	13	7
Site #19	0.4	0.040	4.0	3.1	0.9	0.003	0.014	0.019	0.029	0.007	0.002	0.003	9	7	4	7
Site #20	0.5	0.044	2.7	2.1	0.5	0.020	0.018	0.014	0.025	0.002	0.001	0.002	351	157	12	8
Site #21	0.9	0.039	2.7	2.3	0.5	0.006	0.019	0.012	0.030	0.006	0.002	0.002	190	166	24	5
Site #22	0.7	0.040	3.4	2.7	0.7	0.006	0.032	0.015	0.046	0.008	0.002	0.002	231	182	19	9
Site #23	0.5	0.043	2.8	2.3	0.5	0.005	0.012	0.039	0.038	0.021	0.001	0.002	17	9	3	18
Five-minute Peak	1.6	0.044	11.2	5.6	7.0	0.020	0.046	0.039	0.068	0.024	0.019	0.019	391	235	24	62

Table 4 shows **overall average** air quality parameter concentrations at all monitoring locations in the County of Grande Prairie for the entire monitoring period (December 1 to 15, 1998) compared with other locations in Alberta.

Monitoring Location	CO (ppm)	O ₃ (ppm)	THC (ppm)	CH ₄ (ppm)	RHC (ppm)	SO ₂ (ppm)	NO (ppm)	NO ₂ (ppm)	NO _x (ppm)	NH ₃ (ppm)	TRS (ppm)	H ₂ S (ppm)	TSP (ug/m ³)	PM ₁₀ (ug/m ³)	PM _{2.5} (ug/m ³)	PAH (ng/m ³)
County of Grande Prairie	0.3	0.029	2.5	1.9	0.5	0.001	0.005	0.005	0.009	0.001	0.001	0.001	9	5	1	2
Beaverlodge	no data	0.028			no data		0.004	0.009	0.013				no data			
High Tower Ridge	no data	0.044								no data						
Violet Grove	no data	0.032		no data		0.003	0.001	0.006	0.007				no data			
Edmonton Central	1.4	0.007	2.4		no data		0.055	0.037	0.092				no data			
Edmonton East	0.6	0.013	1.9		no data	0.003	0.036	0.032	0.067	no data		0.001	no data	24		no data
Edmonton Northwest	1.3	0.010	2.5		no data		0.065	0.035	0.100	no data		no data	no data	24	17	no data
Fort Saskatchewan	0.7	0.013	2.1		no data	0.003	0.031	0.023	0.053	0.006	no data	0.000			no data	
Fort McMurray	0.6	0.010	2.0		no data	0.001	0.020	0.016	0.035			no data			70	no data
Calgary East	1.4	0.010	2.3		no data	0.005	0.106	0.036	0.142	no data		0.002			no data	

Table 5 shows **maximum one-hour** air quality parameter concentrations at all monitoring locations in the County of Grande Prairie for the entire monitoring period (December 1 to 15, 1998) compared with other locations in Alberta.

Monitoring Location	CO (ppm)	O ₃ (ppm)	THC (ppm)	CH ₄ (ppm)	RHC (ppm)	SO ₂ (ppm)	NO (ppm)	NO ₂ (ppm)	NO _x (ppm)	NH ₃ (ppm)	TRS (ppm)	H ₂ S (ppm)	TSP (ug/m ³)	PM ₁₀ (ug/m ³)	PM _{2.5} (ug/m ³)	PAH (ng/m ³)
County of Grande Prairie	0.6	0.043	7.2	4.0	3.3	0.008	0.027	0.019	0.040	0.006	0.010	0.009	106	47	6	12
Beaverlodge	no data	0.042			no data		0.039	0.027	0.061				no data			
High Tower Ridge	no data	0.050								no data						
Violet Grove	no data	0.046		no data		0.039	0.012	0.021	0.023				no data			
Edmonton Central	2.9	0.029	3.1		no data		0.159	0.053	0.202				no data			
Edmonton East	1.3	0.038	4.4		no data	0.015	0.145	0.055	0.189	no data		0.004	no data	90		no data
Edmonton Northwest	3.6	0.041	3.7		no data		0.217	0.062	0.274	no data		no data	no data	99	41	no data
Fort Saskatchewan	2.9	0.042	3.3		no data	0.011	0.200	0.051	0.235	0.027	no data	0.002			no data	
Fort McMurray	3.2	0.036	2.9		no data	0.002	0.162	0.041	0.193			no data			162	no data
Calgary East	5.4	0.034	3.3		no data	0.014	0.471	0.075	0.546	no data		0.014			no data	
One-Hour Guideline	13.0	0.082	n/a	n/a	n/a	0.170	n/a	0.210	n/a	2.000	n/a	0.010	n/a	n/a	n/a	n/a

Table 6 shows one-hour average air quality parameter concentrations and weather conditions at each monitoring location on December 1 to 6 survey days in the County of Grande Prairie. The "Less than 75%" indicates that less than 75% of data for a specific hour was available because of interference from MAML generator exhaust or instrument malfunction.

Date	Monitoring Location	CO (ppm)	O ₃ (ppm)	THC (ppm)	CH ₄ (ppm)	RHC (ppm)	SO ₂ (ppm)	NO (ppm)	NO ₂ (ppm)	NO _x (ppm)	NH ₃ (ppm)	TRS (ppm)	H ₂ S (ppm)	TSP (ug/m ³)	PM ₁₀ (ug/m ³)	PM _{2.5} (ug/m ³)	PAH (ng/m ³)	Temp. (°C)	RH (%)	WSP (km/h)	WDR
1-Dec	Site 12 (9:51 a.m. to 11:05 a.m.)	0.2	0.014	3.2	2.7	0.5	0.001	0.016	0.009	0.025	0.002	0.001	0.001	-	-	-	3	-13.6	84	3.8	WSW
	Site 8 (11:32 a.m. to 12:32 p.m.)	0.2	0.012	2.9	2.2	0.5	0.001	0.025	0.015	0.040	0.002	0.001	0.001	-	-	-	3	-7.7	76	2.6	ESE
	Site 9 (12:52 p.m. to 2:07 p.m.)	0.1	0.018	3.3	2.4	0.7	0.000	0.016	0.008	0.024	0.001	0.000	0.001	-	-	-	3	-9.1	78	2.7	SSW
	Site 11 (3:08 p.m. to 4:07 p.m.)	0.0	0.025	3.2	2.3	0.6	0.001	0.007	0.009	0.016	0.001	0.001	0.001	-	-	-	3	-11.7	86	12.9	NE
	Site 19 (5:00 p.m. to 6:00 p.m.)	0.1	0.010	3.3	2.5	0.7	0.001	0.006	0.017	0.023	0.003	0.002	0.001	-	-	-	4	-16.8	91	4.9	N
	Site 18 (6:29 p.m. to 7:30 p.m.)	0.1	0.014	6.8	3.9	2.4	0.002	0.008	0.019	0.026	0.002	0.002	0.009	-	-	-	5	-12.7	93	2.5	WSW
2-Dec	Site 18 (7:34 p.m. to 8:38 p.m.)	-	-	-	-	-	0.002	-	-	-	-	0.008	0.007	-	-	-	-	-12.5	91	1.7	SW
	Site 22 (9:53 a.m. to 11:00 a.m.)	-	-	-	-	-	0.001	-	-	-	-	0.001	0.002	-	-	-	-	-8.8	96	1.5	WSW
	Site 21 (11:15 a.m. to 12:19 a.m.)	0.6	0.013	2.7	2.2	0.4	0.002	0.015	0.009	0.024	0.006	0.001	0.002	24	21	6	4	-8.3	91	3.8	SW
	Site 23 (12:39 p.m. to 1:37 p.m.)	0.4	0.021	2.6	2.0	0.4	0.010	0.008	0.018	0.002	0.001	0.001	0.001	7	5	3	3	-5.9	79	5.0	NW
	Site 20 (2:43 p.m. to 3:42 p.m.)	0.3	0.028	2.4	2.2	0.3	0.003	0.006	0.008	0.014	0.001	0.001	0.001	43	23	2	4	-2.1	75	3.2	W
	Site 16 (4:12 p.m. to 5:10 p.m.)	0.4	0.017	3.4	2.5	0.9	0.002	0.005	0.013	0.018	0.002	0.001	0.001	46	28	3	5	-11.9	94	4.1	NW
3-Dec	Site 13 (5:34 p.m. to 6:53 p.m.)	0.5	0.024	7.2	4.0	3.3	0.002	0.015	0.012	0.027	0.003	0.001	0.001	3	2	1	2	-6.0	94	2.8	SSE
	Site 14 (6:58 p.m. to 8:08 p.m.)	-	-	-	-	-	0.002	-	-	-	-	0.002	0.003	-	-	-	-	-6.4	95	0.6	S
	Site 2 (9:07 a.m. to 10:09 a.m.)	0.4	0.014	2.4	1.9	0.3	0.001	0.008	0.008	0.017	0.002	0.001	0.002	4	3	2	2	-10.1	94	4.9	NW
	Site 10 (10:41 a.m. to 11:47 a.m.)	0.4	0.025	2.3	1.9	0.3	0.002	0.006	0.001	0.007	0.003	0.001	0.001	2	2	1	2	-8.4	92	6.3	NNW
	Site 7 (12:24 p.m. to 1:25 p.m.)	0.4	0.024	2.2	1.8	0.3	0.003	0.006	0.001	0.007	0.002	0.001	0.001	2	2	2	2	-5.0	74	3.7	NW
	Site 6 (1:45 p.m. to 2:58 p.m.)	0.4	0.026	2.2	1.8	0.2	0.002	0.005	0.001	0.006	0.002	0.001	0.001	3	2	1	2	-7.8	84	5.7	NNW
4-Dec	Site 4 (3:19 p.m. to 4:17 p.m.)	-	-	-	-	-	0.002	-	-	-	-	0.001	0.001	-	-	-	-	-10.5	88	0.6	W
	Site 5 (4:43 p.m. to 5:41 p.m.)	-	-	-	-	-	0.002	-	-	-	-	0.001	0.001	-	-	-	-	-11.3	94	1.5	W
	Site 3 (6:13 p.m. to 7:22 p.m.)	0.5	0.021	2.3	1.9	0.3	0.001	0.006	0.003	0.009	0.001	0.001	0.001	5	3	2	2	-9.0	93	2.9	SSW
	Site 8 (9:10 a.m. to 10:10 a.m.)	0.4	0.011	2.8	2.2	0.4	0.004	0.004	0.005	0.009	0.002	0.001	0.002	4	4	3	4	-11.8	93	2.0	NNW
	Site 9 (10:32 a.m. to 11:33 a.m.)	0.2	0.008	2.9	2.2	0.5	0.000	0.013	0.011	0.024	0.002	0.001	0.001	9	8	3	4	-13.0	92	2.3	NE
	Site 11 (11:55 a.m. to 12:58 p.m.)	0.3	0.014	3.9	2.8	1.0	0.001	0.007	0.005	0.012	0.002	0.001	0.001	8	6	3	3	-11.4	93	2.2	SW
5-Dec	Site 12 (1:43 p.m. to 2:42 p.m.)	-	-	-	-	-	0.001	-	-	-	-	0.001	0.002	-	-	-	-	-8.7	84	2.6	SE
	Site 19 (2:53 p.m. to 3:52 p.m.)	-	-	-	-	-	0.001	-	-	-	-	0.001	0.002	-	-	-	-	-9.2	88	2.2	S
	Site 18 (3:58 p.m. to 5:01 p.m.)	0.2	0.015	3.3	2.5	0.7	0.000	0.007	0.011	0.018	0.002	0.001	0.001	18	15	4	3	-10.8	95	1.2	WSW
	Site 17 (5:29 p.m. to 6:29 p.m.)	-	-	-	-	-	0.001	-	-	-	-	0.002	0.001	-	-	-	-	-13.8	94	2.5	W
	Site 21 (8:31 a.m. to 10:31 a.m.)	0.4	0.017	2.5	2.0	0.2	0.001	0.004	0.006	0.010	0.002	0.001	0.002	4	4	2	2	-11.1	88	2.0	N
	Site 22 (10:39 a.m. to 11:39 a.m.)	0.3	0.022	2.3	1.9	0.2	0.000	0.003	0.003	0.006	0.002	0.001	0.001	7	5	3	2	-8.1	80	2.0	NW
6-Dec	Site 23 (12:01 p.m. to 1:01 p.m.)	-	-	-	-	-	0.002	-	-	-	-	0.001	0.002	-	-	-	-	-5.4	80	1.6	SSW
	Site 20 (2:06 p.m. to 3:12 p.m.)	-	-	-	-	-	0.001	-	-	-	-	0.001	0.001	-	-	-	-	-1.9	70	0.9	SW
	Site 16 (3:34 p.m. to 4:35 p.m.)	0.4	0.018	3.2	2.5	0.5	0.001	0.005	0.013	0.018	0.002	0.001	0.001	41	20	2	3	-5.7	82	2.1	SW
	Site 13 (5:01 p.m. to 6:01 p.m.)	0.5	0.021	3.5	2.5	1.0	0.001	0.003	0.010	0.013	0.002	0.001	0.001	9	7	2	4	-6.5	91	3.6	NNW
	Site 14 (6:06 p.m. to 7:05 p.m.)	-	-	-	-	-	0.002	-	-	-	-	0.001	0.001	-	-	-	-	-8.1	81	2.2	SW
	Site 10 (10:17 a.m. to 11:17 a.m.)	0.6	0.004	3.9	3.0	0.8	0.000	0.027	0.014	0.040	0.003	0.001	0.002	14	12	4	12	-13.1	79	1.4	W
7-Dec	Site 7 (11:41 a.m. to 12:41 p.m.)	-	-	-	-	-	0.000	-	-	-	-	0.001	0.001	-	-	-	-	-0.4	67	3.2	SW
	Site 6 (12:54 p.m. to 1:54 p.m.)	0.2	0.026	2.2	1.8	0.2	0.003	0.007	0.004	0.011	0.001	0.000	0.000	5	2	0	2	-0.2	66	4.3	NNW
	Site 5 (2:12 p.m. to 3:13 p.m.)	-	-	-	-	-	0.000	-	-	-	-	0.001	0.001	-	-	-	-	0.1	61	3.1	SSW
	Site 4 (3:42 p.m. to 4:42 p.m.)	0.1	0.038	2.0	1.7	0.1	0.000	0.002	0.000	0.002	0.002	0.001	0.000	2	1	0	1	-0.4	56	16.8	WSW
	Site 3 (5:03 p.m. to 6:03 p.m.)	0.2	0.038	2.0	1.7	0.1	0.000	0.003	0.001	0.005	0.004	0.000	0.000	4	2	0	2	-1.8	58	5.9	WSW
	Site 2 (6:25 p.m. to 7:22 p.m.)	0.0	0.038	2.1	1.7	0.1	0.000	0.002	0.001	0.004	0.000	0.000	0.000	3	2	0	2	-3.5	63	5.7	SW

* Less than 75% of data available for one hour period due to interference from MAML generator exhaust or instrument malfunction

List of Air Quality and Weather Parameters

CO - carbon monoxide	RHC - reactive hydrocarbons	NO _x - total oxides of nitrogen	PAH - polycyclic aromatic hydrocarbons	Temp - ambient temperature
O ₃ - ozone	SO ₂ - sulphur dioxide	NH ₃ - ammonia	TSP - total suspended particulates	RH - relative humidity
THC - total hydrocarbons	NO - nitric oxide	TRS - total reduced sulphur	PM ₁₀ - inhalable particulates	WSP - wind speed
CH ₄ - methane	NO ₂ - nitrogen dioxide	H ₂ S - hydrogen sulphide	PM _{2.5} - respirable particulates	WDR - wind direction

Table 7 shows one-hour average air quality parameter concentrations and weather conditions at each monitoring location on December 10 to 15 survey days in the County of Grande Prairie. The " " indicates that less than 75% of data for a specific hour was available because of interference from MAMLI generator exhaust or instrument malfunction.

Table 7: One-hour Average Air Quality Parameter Concentrations and Weather Conditions at Each Monitoring Site (December 10 to 15, 1998)																					
Date	Monitoring Location	CO (ppm)	O3 (ppm)	THC (ppm)	CH4 (ppm)	RHC (ppm)	SO2 (ppm)	NO (ppm)	NO2 (ppm)	NOX (ppm)	NH3 (ppm)	TRS (ppm)	H2S (ppm)	TSP (ug/m3)	PM10 (ug/m3)	PM2.5 (ug/m3)	PAH (ng/m3)	Temp. (oC)	RH (%)	WSP (km/h)	WDR
10-Dec	Site 8 (9:04 a.m. to 10:06 a.m.)	0.1	0.036	2.1	18	0.3	0.000	0.002	0.000	0.002	0.002	0.001	0.002	1	0	0	1	4.3	79	18.7	WSW
	Site 9 (10:22 a.m. to 11:24 a.m.)	0.1	0.038	2.4	19	0.5	0.003	0.003	0.002	0.005	0.002	0.001	0.001	1	1	0	3	4.2	75	21.1	WSW
	Site 11 (12:08 p.m. to 1:09 p.m.)	0.3	0.040	2.1	18	0.3	0.000	0.001	0.000	0.000	0.002	0.001	0.001	1	1	0	2	4.0	70	34.0	WSW
	Site 12 (1:28 p.m. to 2:27 p.m.)	0.2	0.039	2.0	17	0.3	0.000	0.001	0.001	0.001	0.002	0.001	0.001	0	0	0	2	3.8	75	26.8	WSW
	Site 19 (2:43 p.m. to 3:42 p.m.)	0.2	0.039	2.0	17	0.3	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	1	0	0	2	4.1	72	20.4
11-Dec	Site 18 (3:53 p.m. to 4:54 p.m.)	0.2	0.037	3.1	25	0.6	0.003	0.001	0.003	0.004	0.002	0.001	0.001	1	1	0	2	2.9	77	16.4	SW
	Site 17 (5:29 p.m. to 6:29 p.m.)	0.2	0.039	2.2	19	0.3	0.001	0.001	0.001	0.002	0.002	0.001	0.001	1	1	0	2	2.2	70	26.4	WSW
	Site 22 (9:15 a.m. to 10:16 a.m.)	0.2	0.037	2.1	17	0.4	0.000	0.003	0.007	0.008	0.001	0.000	0.000	4	2	1	3	-1.4	73	9.6	WSW
	Site 21 (10:29 a.m. to 11:31 a.m.)	0.2	0.037	2.2	17	0.4	0.000	0.000	0.006	0.006	0.001	0.000	0.000	4	2	1	2	-1.9	74	9.5	WSW
	Site 23 (11:55 a.m. to 12:55 p.m.)	0.1	0.041	2.1	17	0.4	0.000	0.000	0.002	0.002	0.001	0.000	0.000	6	3	0	2	-0.3	68	8.6	WSW
12-Dec	Site 20 (1:43 p.m. to 2:49 p.m.)	0.2	0.043	2.1	1.7	0.4	0.008	0.002	0.002	0.002	0.001	0.000	0.000	10	4	0	2	1.3	59	7.3	S
	Site 16 (3:22 p.m. to 4:27 p.m.)	0.2	0.038	2.4	18	0.6	0.000	0.001	0.003	0.003	0.001	0.000	0.000	9	5	1	3	-1.7	69	9.0	ESE
	Site 13 (4:48 p.m. to 5:54 p.m.)	0.2	0.038	2.4	18	0.7	0.002	0.001	0.003	0.002	0.001	0.000	0.000	5	2	1	2	-10.3	91	2.6	W
	Site 14 (6:04 p.m. to 7:07 p.m.)	0.4	0.017	2.3	18	0.5	0.001	0.000	0.003	0.002	0.001	0.000	0.000	5	2	1	3	-4.4	83	1.7	SW
	Site 3 (10:38 a.m. to 11:56 a.m.)	0.3	0.022	2.5	19	0.7	0.001	0.004	0.010	0.014	0.001	0.000	0.000	14	7	1	3	-5.0	83	0.9	WSW
13-Dec	Site 4 (12:15 p.m. to 1:14 p.m.)	0.4	0.022	2.7	2.1	0.7	0.001	0.001	0.006	0.007	0.001	0.000	0.000	12	2	2	2	-0.5	83	0.9	WSW
	Site 10 (1:55 p.m. to 2:56 p.m.)	0.2	0.028	2.1	17	0.5	0.004	0.002	0.010	0.012	0.001	0.000	0.001	5	3	1	3	-0.3	75	1.3	SW
	Site 5 (3:08 p.m. to 4:09 p.m.)	0.3	0.032	2.0	16	0.4	0.004	0.001	0.007	0.007	0.003	0.000	0.000	4	3	1	2	-1.0	81	3.1	S
	Site 6 (4:45 p.m. to 5:45 p.m.)	0.5	0.030	2.2	1.5	0.7	0.003	0.002	0.005	0.007	0.001	0.000	0.000	2	2	0	2	2.3	74	0.9	SW
	Site 2 (6:36 p.m. to 7:36 p.m.)	0.1	0.036	2.0	1.5	0.6	0.001	0.002	0.002	0.002	0.001	0.000	0.000	0	0	0	1	1.6	93	13.4	SSW
14-Dec	Site 8 (8:45 a.m. to 9:50 a.m.)	0.3	0.034	2.7	1.6	1.2	0.002	0.002	0.002	0.002	0.001	0.000	0.000	1	1	1	3	1.6	95	6.4	WSW
	Site 9 (10:02 a.m. to 11:03 a.m.)	0.2	0.035	2.4	1.6	0.9	0.001	0.009	0.000	0.009	0.000	0.000	0.000	0	0	0	1	1.8	92	8.0	SW
	Site 11 (11:29 a.m. to 12:29 p.m.)	0.2	0.035	2.4	1.6	0.9	0.001	0.009	0.000	0.009	0.000	0.000	0.000	0	0	0	2	2.3	88	10.5	SW
	Site 12 (1:00 p.m. to 2:01 p.m.)	0.2	0.039	1.7	1.3	0.5	0.001	0.004	0.000	0.002	0.000	0.001	0.000	0	1	0	4	2.4	85	6.2	SW
	Site 19 (2:09 p.m. to 3:22 p.m.)	0.2	0.036	1.6	1.2	0.4	0.001	0.003	0.003	0.006	0.001	0.001	0.000	1	1	0	2	1.6	83	10.6	SSW
15-Dec	Site 18 (3:34 p.m. to 4:35 p.m.)	0.2	0.036	1.9	1.3	0.5	0.002	0.000	0.004	0.004	0.001	0.000	0.000	2	1	0	2	-0.7	85	4.3	SSW
	Site 17 (5:03 p.m. to 6:13 p.m.)	0.2	0.033	1.6	1.2	0.4	0.001	0.003	0.005	0.006	0.001	0.000	0.000	2	1	0	2	-5.3	69	12.8	W
	Site 22 (9:15 a.m. to 10:14 a.m.)	0.1	0.038	2.1	1.7	0.3	0.002	0.003	0.003	0.005	0.000	0.000	0.000	2	1	0	2	-5.9	69	22.3	WSW
	Site 21 (10:34 a.m. to 11:39 a.m.)	0.2	0.037	2.1	1.7	0.3	0.003	0.001	0.006	0.006	0.001	0.002	0.000	3	2	0	2	-3.5	64	11.6	W
	Site 23 (12:12 p.m. to 1:15 p.m.)	0.2	0.040	2.1	1.7	0.2	0.001	0.001	0.005	0.005	0.004	0.000	0.000	10	4	1	3	-3.0	52	3.9	SW
15-Dec	Site 20 (1:45 p.m. to 2:45 p.m.)	0.2	0.041	2.1	1.7	0.2	0.001	0.002	0.002	0.003	0.000	0.000	0.000	106	47	4	2	-3.4	58	14.0	SSW
	Site 16 (3:07 p.m. to 4:07 p.m.)	0.2	0.041	2.1	1.7	0.2	0.001	0.000	0.002	0.001	0.000	0.000	0.000	13	7	1	2	-6.3	66	8.8	SSW
	Site 13 (4:29 p.m. to 5:35 p.m.)	0.3	0.035	2.2	1.7	0.4	0.001	0.002	0.008	0.009	0.000	0.000	0.000	31	17	2	2	-7.8	74	10.1	WSW
	Site 15 (5:51 p.m. to 6:50 p.m.)	0.4	0.040	2.2	1.7	0.5	0.002	0.000	0.002	0.001	0.001	0.000	0.000	9	5	1	2	-7.7	77	10.1	SW
	Site 10 (8:30 a.m. to 9:38 a.m.)	0.3	0.037	2.0	1.6	0.2	0.001	0.001	0.001	0.001	0.001	0.000	0.000	2	1	0	2	-0.1	71	3.3	NW
15-Dec	Site 7 (10:00 a.m. to 11:01 a.m.)	0.2	0.037	2.0	1.6	0.2	0.001	0.001	0.001	0.001	0.000	0.000	0.000	2	1	0	2	3.0	61	11.8	WNW
	Site 6 (11:22 a.m. to 12:22 p.m.)	0.3	0.034	2.1	1.8	0.2	0.006	0.001	0.006	0.004	0.000	0.000	0.000	2	1	0	2	3.6	58	16.1	W
	Site 4 (12:41 p.m. to 1:41 p.m.)	0.3	0.038	2.0	1.6	0.2	0.001	0.000	0.003	0.000	0.000	0.000	0.000	2	1	0	1	3.3	58	23.0	W
	Site 5 (2:00 p.m. to 3:01 p.m.)	0.4	0.040	1.9	1.6	0.2	0.001	0.000	0.003	0.000	0.000	0.000	0.000	1	1	0	1	1.6	53	9.0	WSW
	Site 3 (3:38 p.m. to 4:53 p.m.)	0.6	0.041	1.9	1.6	0.2	0.001	0.001	0.003	0.001	0.003	0.001	0.000	1	1	0	2	1.6	53	9.0	WSW
15-Dec	Site 2 (5:14 p.m. to 6:14 p.m.)	0.3	0.037	2.0	1.6	0.2	0.002	0.001	0.007	0.004	0.003	0.001	0.000	8	5	1	2	-0.6	74	3.8	SSW

* Less than 75% of data available for one hour period due to interference from MAMLI generator exhaust or instrument malfunction

List of Air Quality and Weather Parameters

CO - carbon monoxide	RHC - reactive hydrocarbons	NO _x - total oxides of nitrogen	PAH - polycyclic aromatic hydrocarbons	Temp - ambient temperature
O ₃ - ozone	SO ₂ - sulphur dioxide	NH ₃ - ammonia	TSP - total suspended particulates	RH - relative humidity
THC - total hydrocarbons	NO - nitric oxide	TRS - total reduced sulphur	PM ₁₀ - inhalable particulates	WSP - wind speed
CH ₄ - methane	NO ₂ - nitrogen dioxide	H ₂ S - hydrogen sulphide	PM _{2.5} - respirable particulates	WDR - wind direction

Table 8 shows five-minute peak air quality parameter concentrations at each monitoring location on December 1 to 6 survey days in the County of Grande Prairie. The "—" indicates that data was not available for a specific five-minute period because of interference from MAMLI generator exhaust or instrument malfunction.

Table 8: Five-minute Peak Air Quality Parameter Concentrations at Each Monitoring Site (December 1 to 6, 1998)																	
Date	Monitoring Location	CO (ppm)	O ₃ (ppm)	THC (ppm)	CH ₄ (ppm)	RHC (ppm)	SO ₂ (ppm)	NO (ppm)	NO ₂ (ppm)	NO _x (ppm)	NH ₃ (ppm)	TRS (ppm)	H ₂ S (ppm)	TSP (ug/m ³)	PM ₁₀ (ug/m ³)	PM _{2.5} (ug/m ³)	PAH (ng/m ³)
1-Dec	Site 12 (9:51 a.m. to 11:05 a.m.)	0.5	0.017	4.5	4.0	1.1	0.001	0.017	0.012	0.028	0.003	0.002	0.002	*	*	*	4
	Site 8 (11:32 a.m. to 12:32 p.m.)	0.7	0.018	3.4	2.3	0.7	0.001	0.046	0.022	0.068	0.002	0.001	0.002	*	*	*	4
	Site 9 (12:52 p.m. to 2:07 p.m.)	0.2	0.019	3.8	2.7	1.0	0.001	0.030	0.011	0.041	0.003	0.001	0.001	*	*	*	4
	Site 11 (3:08 p.m. to 4:07 p.m.)	0.1	0.027	3.4	2.4	0.7	0.002	0.008	0.011	0.018	0.002	0.001	0.001	*	*	*	4
	Site 19 (5:00 p.m. to 6:00 p.m.)	0.4	0.013	3.6	2.6	0.9	0.001	0.009	0.019	0.018	0.002	0.001	0.002	*	*	*	4
2-Dec	Site 18 (6:29 p.m. to 7:30 p.m.)	0.5	0.017	11.2	5.6	4.8	0.003	0.011	0.028	0.038	0.004	0.017	0.017	*	*	*	7
	Site 18 (7:34 p.m. to 8:38 p.m.)	0.8	0.014	4.1	2.8	1.0	0.003	0.014	0.012	0.025	0.002	0.019	0.019	*	*	*	4
	Site 22 (9:53 a.m. to 11:00 a.m.)	0.7	0.010	3.4	2.7	0.7	0.002	0.032	0.014	0.046	0.008	0.002	0.002	231	182	19	7
	Site 21 (11:15 a.m. to 12:19 a.m.)	0.9	0.015	2.7	2.3	0.5	0.003	0.019	0.012	0.030	0.006	0.001	0.002	190	166	24	5
	Site 23 (12:39 p.m. to 1:37 p.m.)	0.5	0.025	2.8	2.3	0.5	0.005	0.012	0.009	0.021	0.003	0.001	0.002	17	9	3	4
3-Dec	Site 20 (2:43 p.m. to 3:42 p.m.)	0.4	0.028	2.5	2.1	0.4	0.005	0.011	0.014	0.025	0.002	0.001	0.002	234	120	9	5
	Site 16 (4:12 p.m. to 5:10 p.m.)	0.4	0.020	4.8	2.9	1.7	0.003	0.008	0.017	0.024	0.004	0.002	0.001	391	235	18	8
	Site 13 (5:34 p.m. to 6:53 p.m.)	0.8	0.031	10.6	5.6	7.0	0.004	0.025	0.022	0.045	0.005	0.002	0.002	2	2	1	2
	Site 14 (6:58 p.m. to 8:08 p.m.)	*	*	*	*	*	0.003	*	*	*	*	0.004	0.004	*	*	*	*
	Site 2 (9:07 a.m. to 10:09 a.m.)	0.5	0.017	2.4	2.0	0.4	0.002	0.011	0.014	0.025	0.003	0.002	0.002	6	5	2	3
4-Dec	Site 2 (9:07 a.m. to 10:09 a.m.)	0.4	0.026	2.3	1.9	0.3	0.002	0.007	0.002	0.008	0.004	0.001	0.002	3	2	2	2
	Site 10 (10:41 a.m. to 11:47 a.m.)	0.5	0.025	2.3	1.8	0.3	0.003	0.006	0.002	0.008	0.002	0.001	0.001	3	3	2	2
	Site 6 (1:45 p.m. to 2:58 p.m.)	0.5	0.027	2.3	1.9	0.3	0.002	0.005	0.003	0.008	0.002	0.001	0.001	5	3	1	3
	Site 4 (3:19 p.m. to 4:17 p.m.)	0.7	0.022	2.4	1.8	0.5	0.004	0.008	0.003	0.010	0.002	0.002	0.002	9	6	2	4
	Site 5 (4:43 p.m. to 5:41 p.m.)	0.6	0.022	2.3	1.8	0.3	0.002	0.006	0.007	0.012	0.003	0.002	0.002	5	4	3	4
5-Dec	Site 3 (6:13 p.m. to 7:22 p.m.)	0.7	0.024	2.5	2.0	0.5	0.002	0.007	0.007	0.014	0.002	0.001	0.001	23	8	3	2
	Site 8 (9:10 a.m. to 10:10 a.m.)	0.6	0.012	2.8	2.2	0.5	0.001	0.005	0.006	0.010	0.002	0.002	0.003	5	4	3	13
	Site 9 (10:32 a.m. to 11:33 a.m.)	0.2	0.010	3.0	2.3	0.6	0.001	0.023	0.014	0.037	0.002	0.002	0.002	14	13	4	7
	Site 11 (11:55 a.m. to 12:56 p.m.)	0.4	0.016	4.2	2.9	1.1	0.002	0.007	0.008	0.013	0.002	0.002	0.002	9	8	3	4
	Site 12 (1:43 p.m. to 2:42 p.m.)	0.3	0.017	4.1	3.0	1.0	0.002	0.009	0.007	0.015	0.002	0.002	0.002	6	6	3	3
6-Dec	Site 19 (2:53 p.m. to 3:52 p.m.)	0.3	0.014	4.0	3.1	0.9	0.002	0.014	0.015	0.029	0.007	0.002	0.003	9	7	4	5
	Site 18 (3:58 p.m. to 5:01 p.m.)	0.4	0.018	4.8	2.8	1.8	0.001	0.008	0.015	0.022	0.004	0.002	0.002	93	80	13	4
	Site 17 (5:29 p.m. to 6:29 p.m.)	0.3	0.010	4.9	2.9	2.1	0.003	0.008	0.016	0.024	0.003	0.002	0.002	44	28	4	6
	Site 21 (9:31 a.m. to 10:31 a.m.)	0.4	0.025	2.6	2.1	0.3	0.001	0.004	0.007	0.010	0.002	0.002	0.002	6	4	2	3
	Site 22 (10:39 a.m. to 11:39 a.m.)	0.4	0.026	2.4	2.0	0.2	0.001	0.004	0.004	0.007	0.002	0.001	0.001	26	12	3	2
7-Dec	Site 23 (12:01 p.m. to 1:01 p.m.)	*	*	*	*	*	0.004	*	*	*	*	0.001	0.002	*	*	*	*
	Site 20 (2:06 p.m. to 3:12 p.m.)	0.5	0.034	2.7	2.1	0.4	0.002	0.007	0.002	0.009	0.002	0.001	0.002	40	18	2	2
	Site 16 (3:34 p.m. to 4:35 p.m.)	0.5	0.019	3.3	2.6	0.7	0.001	0.008	0.016	0.024	0.002	0.002	0.002	167	71	4	4
	Site 13 (5:01 p.m. to 6:01 p.m.)	0.5	0.024	4.8	3.0	1.7	0.002	0.003	0.014	0.017	0.002	0.002	0.001	17	10	2	4
	Site 14 (6:06 p.m. to 7:05 p.m.)	0.4	0.029	2.4	2.0	0.2	0.004	0.003	0.010	0.004	0.002	0.002	0.002	4	2	1	4
8-Dec	Site 10 (10:17 a.m. to 11:17 a.m.)	0.7	0.006	4.0	3.1	0.9	0.001	0.036	0.014	0.049	0.006	0.002	0.002	18	16	5	62
	Site 7 (11:41 a.m. to 12:41 p.m.)	0.8	0.024	2.1	1.8	0.2	0.001	0.009	0.003	0.012	0.007	0.001	0.001	2	2	0	2
	Site 6 (12:54 p.m. to 1:54 p.m.)	0.9	0.030	2.7	2.0	0.5	0.007	0.022	0.016	0.036	0.002	0.001	0.001	19	7	0	5
	Site 5 (2:12 p.m. to 3:13 p.m.)	0.8	0.035	2.6	2.4	0.4	0.001	0.015	0.006	0.021	0.016	0.001	0.001	97	55	8	4
	Site 4 (3:42 p.m. to 4:42 p.m.)	0.1	0.039	2.1	1.8	0.2	0.001	0.003	0.006	0.003	0.003	0.002	0.001	4	2	0	2
9-Dec	Site 3 (5:03 p.m. to 6:02 p.m.)	0.5	0.039	2.1	1.7	0.2	0.000	0.009	0.007	0.010	0.024	0.000	0.000	7	3	0	2
	Site 2 (6:25 p.m. to 7:22 p.m.)	0.1	0.039	2.1	1.8	0.2	0.000	0.003	0.002	0.005	0.001	0.000	0.000	5	4	1	2

* No data available for five minute period due to interference from MAMLI generator exhaust or instrument malfunction

List of Air Quality Parameters

CO - carbon monoxide	RHC - reactive hydrocarbons	NO _x - total oxides of nitrogen	PAN - polycyclic aromatic hydrocarbons
O ₃ - ozone	SO ₂ - sulphur dioxide	NH ₃ - ammonia	TSP - total suspended particulates
THC - total hydrocarbons	NO - nitric oxide	TRS - total reduced sulphur	PM ₁₀ - inhalable particulates
CH ₄ - methane	NO ₂ - nitrogen dioxide	H ₂ S - hydrogen sulphide	PM _{2.5} - respirable particulates

